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U. S. DEPARTMENT OF AGRICULTURE.

SEVENTEENTH ANNUAL REPORT

OF THE

BUREAU OF ANIMAL INDUSTRY

FOR

THE YEAR 1900.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1901.

[PUBLIC—No. 15.]

AN ACT providing for the public printing and binding and the distribution of public documents.

SEC. 73. Extra copies of documents and reports shall be printed promptly when the same shall be ready for publication, and shall be bound in paper or cloth, as directed by the Joint Committee on Printing, and shall be the number following in addition to the usual number:

Of the Report of the Bureau of Animal Industry, 30,000 copies, of which 7,000 shall be for the Senate, 14,000 for the House, and 9,000 for distribution by the Agricultural Department.

Approved, January 12, 1895.

LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF ANIMAL INDUSTRY,
Washington, D. C., June 8, 1901.

SIR: I have the honor to submit herewith the Seventeenth Annual Report of the Bureau of Animal Industry, prepared in accordance with the organic act creating the Bureau, and recommend that it be forwarded to the Public Printer for printing.

Respectfully,

D. E. SALMON,
Chief of Bureau.

Hon. JAMES WILSON,
Secretary.

26814

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SEVENTEENTH ANNUAL REPORT OF THE BUREAU OF ANIMAL INDUSTRY.

REPORT OF THE CHIEF OF THE BUREAU.

INSPECTION DIVISION.

MEAT INSPECTION.

The inspection of meat for the interstate and foreign trade has been conducted during the year on the same principles as heretofore. There has been a great reduction in the amount of microscopic inspection on account of the lessened demand in continental Europe for American pork. This is probably due to the higher price which this article has commanded in the American market.

The expense of microscopic inspection is considerably greater per carcass examined than heretofore, partly because of the irregularity of this work and partly because more time has been given to each specimen examined.

In the general meat inspection much time has been devoted to improving the system and perfecting checks to guard against the use by unscrupulous dealers of meat which has been condemned as unwholesome. The law which is intended to guard against this fraud is not as stringent or as perfect as is desirable, and it requires constant vigilance on the part of the inspectors to accomplish the object of the inspection.

The number of localities where the work of meat inspection was in operation during the year was increased from 41 to 45, while the number of abattoirs and packing houses receiving the benefit of this inspection was 148, as against 138 in the preceding year.

A table on the next page shows the numbers and different kinds of animals inspected before slaughter in stock yards and at abattoirs. As most of the animals are inspected in the stock yards, comparatively few are rejected at the abattoirs. The figures show a material increase in all classes of animals inspected with the exception of hogs, of which the number is noticeably diminished.

Antemortem inspections for the fiscal year 1900.

Kind of animal.	For official abattoirs in cities where inspections were made.	For abattoirs in other cities and miscellaneous buyers.	Total inspections.	Rejected (subject to result of postmortem inspection.)	
				At abattoirs.	In stock yards.
Cattle	5,027,998	4,628,764	9,656,762	214	31,752
Sheep	6,170,172	3,684,560	9,854,732	776	10,725
Calves	308,542	251,193	559,735	265	3,095
Hogs	23,328,102	9,683,103	33,011,205	4,637	107,989
Horses	5,560	....	5,560	66	....
Total	34,840,374	18,247,620	53,087,994	5,958	153,561

The following table showing the total number of animals inspected before slaughter for abattoirs having inspection for the fiscal years 1891 to 1900 is given for the purpose of comparison:

Number of animals inspected before slaughter for abattoirs having inspection, fiscal years 1891 to 1900.

Fiscal year.	Cattle.	Calves.	Sheep.	Hogs.	Horses.	Total.
1891	83,891	....	....	....	....	83,891
1892	3,167,009	59,089	583,361	....	....	3,809,459
1893	3,922,174	92,947	870,512	....	....	4,805,633
1894	3,862,111	96,331	1,020,764	7,964,850	....	12,944,056
1895	3,752,111	109,941	1,344,031	13,576,917	....	18,783,000
1896	4,050,011	213,575	4,710,190	14,301,963	....	23,275,739
1897	4,289,058	259,930	5,179,643	16,813,181	....	26,541,812
1898	4,552,919	241,092	5,706,092	20,713,863	....	31,213,966
1899	4,654,842	245,859	5,718,464	23,783,576	3,232	34,405,973
1900	5,027,998	308,542	6,170,172	23,328,102	5,560	34,840,374

The numbers and classes of animals inspected at time of slaughter and the number of these or parts thereof condemned will be found in the following table:

Postmortem inspection for fiscal year 1900.

Kind of animal.	Number of inspections.			Carcasses condemned.			Parts of carcasses condemned at abattoirs.
	For official abattoirs.	On animals rejected in stock yards.	Total.	For official abattoirs.	Animals rejected in stock yards.	Total.	
Cattle	4,841,166	20,828	4,861,994	6,209	4,029	10,238	8,973
Sheep	6,119,886	5,209	6,125,095	4,234	1,240	5,474	309
Calves	315,693	276	315,969	182	54	236	32
Hogs	23,336,884	92,112	23,428,996	38,598	7,248	45,846	21,032
Horses	5,559	....	5,559	112	....	112	....
Total	34,619,188	118,425	34,737,613	49,335	12,571	61,906	30,346

The above table shows the condemnations made upon ordinary inspection; the additional number resulting from the microscopic inspection of hogs for trichinæ will be referred to under another heading.

Besides the carcasses condemned at slaughter or for trichinosis, a large number, as usual, were tanked because of death resulting from disease or injury, or because the animals had been killed by city inspectors after rejection in the stock yards, or had been found dead in cars or pens at abattoirs. The subjoined table shows the numbers so disposed of:

Manner of death.	Cattle.	Sheep.	Calves.	Hogs.	Horses.	Total.
Died in stock yards	383	974	160	1,854	....	3,371
Killed in stock yards	1,691	1,827	574	6,036	....	10,128
Dead at abattoirs	250	1,118	119	15,426	29	16,942
Total	2,324	3,919	853	23,316	29	30,441

Immediately following is a statement of the total number of carcasses and parts condemned and tanked, including the animals found dead and those killed by the city inspectors, and giving the causes of condemnation at time of slaughter:

Causes of condemnation of carcasses and parts of carcasses for fiscal year 1900.

Cause of condemnation.	Cattle.		Sheep.		Calves.		Hogs.		Horses.
	Carcasses.	Parts.	Carcasses.	Parts.	Carcasses.	Parts.	Carcasses.	Parts.	Carcasses.
Actinomycosis	1,661	766	....	....	3	1	27	9	....
Tuberculosis	4,194	85	993	....	9	....	4,379	1,061	1
Cholera and swine plague	....	....	....	....	....	....	32,859	....	....
Texas fever	49	....	....	....	13	....	....	....	....
Echinococcus	....	203	34	12	1	....	11	476	....
Measles	....	....	....	....	....	....	30	....	....
Scabies	....	....	51	....	....	....	103	....	....
Eczema	....	....	41	....	....	....	17	....	....
Erysipelas	....	....	....	....	....	....	29	....	....
Cancer	92	....	1	....	....	....	5	....	....
Tumor	21	337	7	....	....	....	616	4,696	....
Abscess	107	3,735	351	51	8	4	804	2,427	1
Pneumonia	209	....	263	....	15	....	1,078	....	6
Pleurisy	30	....	83	....	2	....	67	26	1
Bronchitis	....	....	....	....	....	....	....	....	....
Carditis	3	....	1	....	....	....	....	....	1
Enteritis	31	2	86	....	10	....	325	....	1
Peritonitis	170	1	70	....	7	....	409	....	3
Metritis	20	....	8	....	....	....	134	....	1
Nephritis	3	....	74	....	....	....	74	....	....
Uremia	5	....	36	....	3	....	10	....	....
Mammitis	....	....	1	....	....	....	9	582	....
Septicemia	233	....	284	....	8	....	828	....	12
Pyemia	225	....	224	....	6	....	1.635	....	5
Gangrene	21	....	1	....	....	....	19	....	....

Causes of condemnation of carcasses and parts of carcasses for fiscal year 1900—Continued.

Cause of condemnation.	Cattle.		Sheep.		Calves.		Hogs.		Horses.
	Carcasses.	Parts.	Carcasses.	Parts.	Carcasses.	Parts.	Carcasses.	Parts.	Carcasses.
Anemia, emaciation, marasmus	1,546	....	1,730	....	35	....	423	....	87
Ascites	14	....	76	....	....	....	47	....	....
Jaundice	161	675	212	....	6	....	782	....	....
Extreme temperature, various causes	4	....	36	....	4	....	202	....	2
Pregnancy	40	....	30	....	....	....	344	....	....
Recent parturition	17	....	5	....	....	....	60	....	2
Hernia	10	....	4	....	....	....	13	....	....
Downers, bruised, injured, etc	1,366	3,169	756	246	33	27	507	11,805	29
Dead from various causes	633	....	2,092	....	279	....	17,280	....	29
Too young	....	....	1	....	70	....	....	....	....
Leucocythemia	5	....	....	....	....	....	....	....	....
Gastritis	1	....	....	....	....	....	....	....	....
Anthrax	....	....	6	....	....	....	....	....	....
Encephalitis	....	....	1	....	....	....	....	....	....
Distoma	....	....	2	....	....	....	....	....	....
Esophagostoma	....	....	6	....	....	....	....	....	....
Sick	....	....	....	....	3	....	....	....	....
Melanosis	....	....	....	....	....	....	....	....	1
Paraphimosis	....	....	....	....	....	....	....	....	1
Fistula	....	....	....	....	....	....	....	....	6
Open joint	....	....	....	....	....	....	....	....	2
Killed by city inspectors	1,691	....	1,827	....	574	....	6,036	....	....
Total	12,562	8,973	9,393	309	1,089	32	69,162	21,032	141

The meat-inspection tag or brand was placed upon 17,177,442 quarters, 343,427 pieces, and 1,554 sacks of beef, 6,050,444 carcasses of sheep, 310,126 carcasses of calves, 1,138,507 carcasses of hogs, and 653,756 sacks and 48,485 pieces of pork.

The number of packages to which the ordinary meat-inspection stamp was affixed consisted of 5,584,995 containing beef, 24,151 of mutton, 107 of veal, 13,122,677 of pork, and 602 of horseflesh.

The number of cars that were sealed containing inspected products for transshipment to official establishments and other places was 69,937.

The number of ordinary certificates issued, except for horseflesh, was 43,631. The meat products for export covered by these certificates comprised 1,766,234 quarters, 22,844 pieces, and 1,225,214 packages of beef, with a total weight of 438,138,233 pounds; 11,468 packages of mutton, weighing 680,897 pounds; and 46,233 carcasses of hogs and 897,551 packages of pork, weighing 272,050,663 pounds. Eight certificates were issued for 472 packages of horseflesh, weighing 188,800 pounds.

The cost of conducting the work of ordinary meat inspection was $505,280.52; this is an increase of $39,571.29 over the amount expended the previous year, and as this year's total of antemortem inspections is 53,087,944 against 53,223,176 in 1899, the average cost of each inspection is increased from 0.88 cent to 0.95 cent.

The following statement shows the cost of each antemortem inspection from 1893 to 1900, inclusive:

	Cent.		Cent.
1893	4.75	1897	.91
1894	1.75	1898	.80
1895	1.10	1899	.88
1896	.95	1900	.95

MICROSCOPIC INSPECTION OF PORK.

The number of carcasses examined was 999,554, resulting in the following classification: Class A, free from all appearance of trichinæ, 968,405, or 96.88 per cent; Class B, containing trichina-like bodies or disintegrating trichinæ, 11,701, or 1.17 per cent; Class C, containing living trichinæ, 19,448, or 1.95 per cent. The percentages this year are practically the same as those previously found, there being a slight increase in carcasses of Class C.

There were 19,465 trichinous carcasses (including a few left over from preceding year) disposed of; their weight is given as 4,674,363 pounds. Of this quantity, approximately, half was tanked, the rest being turned into cooked meat.

The number of certificates issued for packages bearing the microscopic inspection stamp was 12,107; the number of packages was 253,333, with a weight of 55,809,626 pounds.

The year having witnessed a great falling off in the trade of microscopically inspected pork products, the number of examinations and the number of pounds exported were reduced to about half the figures for 1899, while the expenses were reduced but about one-fourth, and, as a consequence, the relative cost is much more. The figures for this year are: Expenditures, $154,950.22; average for each carcass examined, 15.5 cents; for each pound exported, 0.277 cent. For 1899 the corresponding figures were $198,355.14; 8.9 cents; 0.182 cent.

INSPECTION OF VESSELS AND EXPORT ANIMALS.

While there has been an increase in the total exports of cattle to all countries for 1900 over 1899, the decline in the number of domestic cattle and sheep exported to Europe, noted in the last report, has continued, but there has been an increase in the number of horses over last year of 40 per cent. The figures for Canadian shipments from American ports show a decrease in all classes of animals.

The following table shows the number of American and Canadian animals inspected, number rejected for export, number tagged, and number exported during the fiscal year 1900:

Number of inspections, etc., of American and Canadian animals, fiscal year 1900.

Kind of animal.	American.				Canadian.		
	Number of inspections.	Number rejected.	Number tagged.	Number exported.	Number inspected.	Number rejected.	Number exported.
Cattle	632,512	1,373	318,298	a 305,182	23,652	18	23,634
Sheep	131,313	53	....	b 73,426	28,954	64	28,890
Horses	51,868	173	....	c 37,080	1,447	1	1,446
Hogs	....	....	....	10	....	....	....

a 9,754 via Canada. b 1,581 via Canada. c 410 via Canada.

The figures showing the exports of American and Canadian animals from the United States for 1898 and 1899 are given in the following table for purposes of comparison with the number of inspections, etc., shown in the table immediately preceding:

Number of animals inspected and exported for fiscal years 1898 and 1899.

Kind of animal.	1898.		1899.	
	American.	Canadian.	American.	Canadian.
Cattle	400,512	19,392	311,595	27,797
Sheep	147,907	29,459	98,551	37,206
Horses	29,570	8,955	26,351	2,685

In addition to the above animals inspected for export to Europe, there were also inspected 6 cattle destined to Jamaica and 888 to Bermuda, and 63 Canadian sheep to Argentina.

The number of certificates issued for American cattle was 1,192; the number of clearances of vessels carrying live stock was 862.

The number of American and Canadian animals inspected at port of debarkation by inspectors of this Department stationed at London, Liverpool, and Glasgow, together with the number and percentage lost in transit, is shown in the following table:

Number of animals inspected at time of landing in London, Liverpool, and Glasgow, and loss in transit.

From—	Cattle.			Sheep.			Horses.		
	Landed.	Lost.		Landed.	Lost.		Landed.	Lost.	
	No.	*No.*	*Per ct.*	*No.*	*No.*	*Per ct.*	*No.*	*No.*	*Per ct.*
United States	290,609	556	0.19	71,547	436	0.61	27,836	741	2.59
Canada	19,889	189	.94	24,997	253	1.00	1,228	20	1.60
Total	310,498	745	.24	96,544	689	.71	29,064	761	2.55

Southern cattle inspection.—During the quarantine season of 1899 the employees of this Department supervised the movement of 1,058,484 cattle, in 39,976 cars, from the district infested with the Southern cattle tick (*Boophilus annulatus*); 39,663 cars were cleaned and disinfected.

In Texas 357,422 cattle were inspected and identified by brands as originating north or west of the quarantine line, and were permitted to be shipped by rail or trailed to other States or Territories for grazing.

In conjunction with the authorities of the State of Missouri 6,065 cattle originating in the northern counties of Arkansas were inspected and permitted to be driven into the former State.

The prevention of sheep scab.—The sheep industry of the United States has long suffered severely from the form of scabies produced by the *Psoroptes communis*, and commonly known as sheep scab. Many of the Western States and Territories have been badly infected, and the sheep shipped from these have spread the contagion to the feeding yards, stock yards, stock cars, and to all the ramifications of the channels of interstate commerce. As a result of this dissemination of the contagion, the Eastern feeders who have purchased store sheep have very often found them infected with this troublesome disease. There have consequently been severe losses from the disease in all parts of the country.

It has been a difficult matter to get control of the sheep traffic in such a manner as to prevent the spread of scab, without at the same time too seriously interfering with the marketing of the animals. To lessen the burden of the sheep owners as much as possible, the regulations were at first very simple and easily complied with; they have been made more stringent and effectual as the nature and objects of the requirements became known.

The first step in the process of control was to give notice of the existence of the disease, and of the provisions of the law prohibiting the shipment of diseased or exposed animals from one State or Territory to another. At the same time a bulletin giving information of the nature of the disease and the methods for curing it was widely distributed through the affected sections. Diseased sheep coming into the stock yards were required to be dipped before being shipped to other States or sold as feeders.

As the results of the dipping were not satisfactory, this operation was put under the supervision of Bureau inspectors, and the dipping liquid was required to be made of certain specified ingredients used in proper proportions. Inspectors were also placed at all points where railroads crossed the Missouri River, in order to discover the diseased sheep and stop them before they gained access to the large stock yards of more eastern points. Finally, inspectors were distributed throughout the States where the traffic originates to inspect the sheep and certify to the healthy ones at the time of shipment.

The effect of this work has been very marked. Sheep owners have been encouraged and stimulated to treat their diseased animals and free their ranges from the contagion. There is a much smaller number of diseased sheep found in the stock yards, and the infection is gradually disappearing. A few years more of earnest work will be sufficient to eradicate this disease and to remove in this manner one of the greatest sources of loss to the sheep industry.

Experiments with reference to this disease are in progress at the experiment station of the Bureau. A flock of Delaine Merino sheep has been purchased in order to determine the precise effect of various dips on a standard fine wool. The wool of the Merino sheep is much finer and more closely set than that of most other breeds, and it is a question whether a dip effective for sheep with a smooth skin and straight wool is equally effective when applied to sheep with the fleece and skin of the Merino.

The number of sheep inspected at various places in order to prevent the interstate shipment of diseased sheep was 1,801,379, and the number dipped under the supervision of Bureau inspectors was 626,838.

INSPECTION OF IMPORTED ANIMALS.

The numbers and classes of animals imported from Mexico and inspected at ports of entry along the international boundary line are here given: Cattle, 80,329; sheep, 9,976; hogs, 44; goats, 4,132; horses, 3.

From Canada the imports of animals not subject to detention at quarantine stations comprised 77,693 cattle, 209,373 sheep, 1,886 horses, 1,092 hogs, 6 goats, and 1 deer—total 290,051. Of these, 1,012 cattle, 7,262 sheep, 137 horses, and 180 hogs were imported for breeding purposes.

Through the port of New York there were imported 265 horses and 350 mules; through the port of San Francisco, 8 horses.

The following table shows the number and kinds of animals detained in quarantine for the specified time:

Number of animals imported and quarantined at different stations.

Stations.	Cattle.	Sheep.	Hogs.
Littleton, Mass	....	14	....
Garfield, N. J	379	356	2
Port Huron, Mich	6	....	....
Detroit, Mich	3	....	....
Sault Ste. Marie, Mich	4	....	....
Alexandria Bay, N. Y	5	....	....

Number of animals imported and quarantined at different stations—Continued.

Stations.	Cattle.	Sheep.	Hogs.
Buffalo, N. Y	14	....	....
Ogdensburg, N. Y	3	1	....
St. Albans, Vt	13	....	....
Richford, Vt	1	....	....
Newport, Vt	11	....	....
Beecher Falls, Vt	48	2	1
Island Pond, Vt	34	7	1
Houlton, Me	32	132	2
Vanceboro, Me	31	2	....
Eastport, Me	3	20	....
Total	587	534	6

There were also received at the Garfield station 7 deer, 4 gazelles, 32 camels, 1 goat, 2 zebus.

BIOCHEMIC DIVISION.

TUBERCULIN AND MALLEIN.

In addition to the preparation of tuberculin, which will be mentioned later, the Biochemic Division has made and distributed 10,722 doses of mallein for testing horses for glanders. Considerable quantities of this were used in Minnesota, Iowa, South Dakota, and Oklahoma Territory, but the largest part was supplied to the War Department, and small amounts have been sent to twelve different States.

SERUM FOR HOG CHOLERA AND SWINE PLAGUE.

The work of preparing serum for treating hog cholera and swine plague has been continued this year as last. The number of animals which has been used for the preparation of the serum is about the same as last year. A force of inspectors of the Bureau has been engaged in treating a large number of animals in two counties in Iowa, two of the same counties in which work was conducted during the last year. The results in general, so far as can be determined at the present time, are hardly such as to justify positive conclusions, though sufficiently encouraging to justify continued experimentation.

The preparation of the large quantities of antitoxic serum necessary to conduct this work in the field has entailed a large amount of routine work in the laboratory, and also at the Experiment Station, where the animals for supplying the serum have been treated. Full reports are being kept this year, as last, of the herds that are treated; cultures are taken from the sick animals and are sent to the laboratory for further tests and identification, and care is taken not only to demonstrate so far as possible the exact character of the disease existing in the animals which are treated in the field, but also to test the quantity and character of the serum used for treatment. Important variations in cultures, cultural products, and their bearings which have developed in this work are being carefully studied.

INTERNATIONAL CONGRESSES OF MEDICINE AND HYGIENE.

These two important international congresses, which meet every third year, held their sessions during the present summer. As the investigations conducted in the laboratories of the Bureau of Animal Industry are of such far-reaching importance in the study of diseases of both men and animals, it seemed proper that the Bureau should be represented. Accordingly, Dr. E. A. de Schweinitz, chief of the Biochemic Division, who was in England in connection with some tuberculosis investigations, was instructed to represent the Bureau and the Department of Agriculture at these meetings. Over 6,000 doctors were registered in connection with the International Medical Congress. The work of this congress was divided into a number of different sections, the section on bacteriology embracing the work which was more directly connected with the work of the Biochemic Laboratory. The sessions of this section were held at the Pasteur Institute in the new chemical biologic (or biochemic) laboratory, which has just been completed at an expenditure of several million francs. This laboratory and an excellent new hospital, which has also just been completed, together with the old Pasteur Institute, are to be devoted entirely to the study of bacteria, bacterial products, toxins, and antitoxins in relation to disease, and also to the study of bacteria and bacterial products from an economical standpoint. If the laboratory investigations of the Bureau of Animal Industry conducted in poorly adapted buildings have given such useful results, the benefits which would accrue from investigations conducted in so complete a laboratory as the one referred to, where every possible facility is provided, would be untold.

Dr. de Schweinitz presented to the congress a paper giving a review of the most important experimental work in connection with tuberculosis in the United States during the past ten years. The fact that this section was attended by such men as Duclaux, Metschnikoff, Laveran, Blanchard, Arloing, Buchner, Ehrlich, Salomensen, Roux, Martin, Nocard, and many other of the most prominent scientific men of Europe is evidence of the importance of the Bureau being represented on such occasions and taking an active part in the proceedings. The representative of the Bureau was one of the honorary presidents and presiding officers.

While no new or startling investigations were announced, very many valuable reviews in different lines of work were brought to the attention of the members of the congress, which may be said to have served to a great extent as a "clearing house" and new starting point for continuation of important investigations.

The Congress of Hygiene had a very much smaller number of members than the International Medical Congress, and the matters presented were to some extent the same as those discussed in the International Medical Congress. The paper read here by Dr. de Schweinitz was a review of the work which has been carried on in endeavoring to control tuberculosis in men and animals in the United States. The resolutions adopted and general views of importance expressed will be submitted for publication in the Annual Report of the Bureau.

PATHOLOGICAL DIVISION.

The principal work of this Division during the past fiscal year has consisted in (1) the preparation and distribution of blackleg vaccine; (2) laboratory experiments for diagnostic purposes in connection with an outbreak of rabies in the District of Columbia; (3) an investigation of the nature, cause, and economic importance of caseous lymphadenitis in sheep; (4) an investigation of an outbreak of rabies in the dairy herd of the Government Asylum for the Insane at St. Elizabeth, D. C.; (5) an investigation of the prevalence of tuberculosis in the same herd, and the determination of the pathogenic properties of milk from cows which have reacted to tuberculin, but show no physical symptoms of tuberculosis; (6) an investigation of an outbreak of facial dermatitis in sheep in Maryland; (7) an investigation of several outbreaks of gangrenous vulvitis in cattle; (8) an investigation of an outbreak of an infectious disease among a flock of sheep in Michigan; (9) an investigation regarding the therapeutic value of the so-called gasoline treatment for parasitic diseases in sheep; (10) an investigation regarding infectious abortion in cattle; (11) the determination of pathological specimens referred to this Division for diagnosis; (12) the preparation of answers to numerous inquiries regarding diseases of live stock in the United States.

In addition to the above, it has devolved upon the chief of this Division to prepare the examination for veterinarians in the United States cavalry and to grade the numerous papers according to their merits.

THE PREPARATION AND DISTRIBUTION OF BLACKLEG VACCINE.

During the past fiscal year 1,076,150 doses of blackleg vaccine have been prepared and distributed among the various States and Territories, as itemized below. The demand for this preventive is steadily increasing, and the summarized reports of 2,000 cattle owners testify to the great efficiency of the preparation in reducing losses from blackleg to a minimum. It is conservatively estimated that the annual loss from this disease when no preventive measures are taken amounts to about $6,000,000. This estimate is based upon the reported loss of from 10 to 25 per cent of all young stock in the vast districts of this country where blackleg prevails.

So far as can be judged at the present time the loss after vaccination during the past year has been less than one-half of 1 per cent.

Since the beginning of the distribution of blackleg vaccine in August, 1897, the total number of doses furnished to the cattle raisers of this country amounts to 1,711,900, and the indications are that between 2,000,000 and 2,500,000 doses will be required to supply the demand during the fiscal year ending June 30, 1901.

Number of doses of blackleg vaccine distributed during fiscal year ending June 30, 1900, by States.

	Number.		Number.
Arizona	3,750	Nevada	1,390
Arkansas	420	North Carolina	3,315
California	8,585	North Dakota	76,325
Colorado	99,340	Ohio	60
Georgia	20	Oklahoma	42,085
Idaho	4,595	Oregon	6,655
Illinois	1,535	Pennsylvania	2,045
Indiana	600	Philippine Islands	50
Indian Territory	28,495	South Dakota	91,575
Iowa	13,325	Tennessee	1,970
Kansas	172,535	Texas	189,235
Kentucky	4,235	Utah	6,725
Louisiana	75	Vermont	410
Michigan	170	Virginia	19,190
Minnesota	13,835	West Indies	500
Mississippi	340	Washington	2,615
Missouri	19,420	West Virginia	2,770
Montana	23,560	Wisconsin	540
Nebraska	185,580	Wyoming	38,600
New Mexico	9,215		
New York	465	Total	1,076,150

RABIES IN THE DISTRICT OF COLUMBIA.

There has been a marked increase in the number of rabid dogs discovered in the District of Columbia during the past year. In previous years the number brought to the attention of this Bureau was as follows: In 1893, 11; 1895, 2; 1896, 5; 1897, 3; 1898, 7; 1899, January 1 to June 30, 4. For the fiscal year ending June 30, 1900, the number of cases was: August, 1; October, 2; November, 5; December, 7; January, 5; February, 6; March, 4; April, 6; May, 6; June, 3—total, 45. In addition, 4 cows, 1 cat, and 1 horse were tested and found to have died of rabies. Four men and 16 children were bitten.

The continued prevalence of this terrible and fatal disease at the seat of the Federal Government is a serious condition and one which demands earnest consideration. Rabies is a disease which originates only from contagion; in the vast majority of cases it is caused by the bite of a rabid dog. If, when an outbreak occurs, dogs are kept securely isolated or are properly muzzled for a sufficient time to cover the period of incubation, the disease is easily stamped out. It seems inexcusable, therefore, to allow the contagion to be propagated indefinitely, causing untold suffering to the affected animals and menacing the lives of persons, particularly children, who go upon the streets.

Rabies is worthy of the attention of the Federal authorities, not only because it has been so frequent at the seat of government where Federal laws alone apply, but because rabid dogs are liable to be conveyed or to cross into the States of Maryland or Virginia, thus carrying the contagion.

Section 8 of the act of Congress approved May 29, 1884, makes it the duty of the Commissioners of the District of Columbia "whenever any contagious, infectious, or communicable disease affecting domestic animals" shall be brought into or shall break out in the District, to take measures to suppress the same promptly and to prevent the same from spreading, and to report to the Secretary of Agriculture whatever they may do in pursuance of the provisions of this section. In order to cooperate with the Dictrict government in harmony with the spirit of section 3 of the act mentioned, all dogs suspected of having rabies have been received at the laboratory of this Bureau, and have been tested by postmortem examination and by inoculation experiments to determine positively as to whether they were so diseased, and the health department has been advised of the result of the tests. Public notice was also given by the issuance of a Department order of the existence of rabies in the District, and prohibiting the movement of dogs between the District and the adjoining States, except under conditions which would prevent the spread of the contagion.

The Commissioners of the District ordered the muzzling of dogs for a time, but the order was so generally disregarded by dog owners, either by allowing dogs to run at large without any muzzle or by the use of inefficient and worthless muzzles, that the measure had no appreciable effect upon the progress of the outbreak. There was increased activity on the part of the authorities in catching and destroying unlicensed dogs, which unquestionably had considerable effect in limiting the extension of the contagion. New cases of the disease, however, continue to develop, and the contagion still exists, menacing human life and threatening the animals of the District and of surrounding States.

As rabies is a disease which can be best controlled by local authorities, since such authorities already have the machinery for seizing dogs and for properly disposing of them, it has not been deemed advisable for the Bureau to take any active steps for the suppression of this outbreak. Nevertheless, it is plain that unless the disease soon disappears of itself it will be the duty of the Bureau to take adequate steps to protect the several States from the contagion which is being harbored in the District. There have been cases of rabies already reported just beyond the District boundary, which presumably were due to extension of the contagion from the District.

The number of children bitten by rabid animals is sufficient to excite the fears of all parents, and should be an adequate reason for the most stringent measures of eradication. It is fortunate that the Pasteur treatment has been available, and that nearly or quite all of the bitten persons have taken it, otherwise it is likely that in this number there would have been several deaths. This treatment, however, is expensive, it is painful, it requires time, and it is not infallible, although it has reduced the deaths among bitten persons to 0.5 per cent, or 1 in 200. The children bitten have usually been those of people in moderate circumstances and the cost of treatment has been a serious burden and hardship to them.

A disease of this nature is one from which the people rightfully expect protection from their Government. It is a danger which they can not avoid by individual effort. It menaces their most cherished possessions—their children. It is a disease so terrible in its manifestations, so frightful in the suffering which it causes, that no child should be unnecessarily exposed to it, and no parent should be placed in the position of seeing his child die in agonies that would haunt his memory for all time.

In view of the practically continuous existence of the rabies contagion in the District of Columbia for the past three years, I would recommend either that Congress authorize the Secretary of Agriculture to pay out of the appropriation for the Bureau of Animal Industry for the treatment of bitten children whose parents would be burdened by such expense, or that the Surgeon-General of the Army or the Marine-Hospital Service be directed to establish an institution for such treatment and to administer the same without charge.

The following table shows in detail the number of animals proved by inoculation experiments to have been rabid:

Animals proved by inoculation experiments to have been rabid, and persons bitten, fiscal year July 1, 1899, to June 30, 1900.

Date.	Record number of dog.	Animals other than dogs.	Persons bitten.
August 30, 1899	52		
October 27, 1899	53		2 children.
October 30, 1899	51		2 men.
November 2, 1899	55		
November 4, 1899	56		1 man.
November 13, 1899	57		
November 15, 1899	58		
November 29, 1899	59		
December 4, 1899		1 cow.	

Animals proved by inoculation experiments to have been rabid, and persons bitten, fiscal year July 1, 1899, to June 30, 1900—Continued.

Date.	Record number of dog.	Animals other than dogs.	Persons bitten.
December 9, 1899	61		1 child.
Do.	62		Do.
December 18, 1899	64		
Do.	66		1 boy.
December 19, 1899	68		2 children.
December 20, 1899		1 cat	2 boys.
December 21, 1899	70		
December 28, 1899	71		
January 6, 1900	74		
January 10, 1900	75		
January 16, 1900	76		1 girl.
January 26, 1900	78		
January 30, 1900	79		
February 5, 1900	80		
February 6, 1900	81		1 boy.
February 12, 1900	83		
February 13, 1900	84		
February 17, 1900	85		
February 21, 1900	86		
March 9, 1900		2 cows.	
March 15, 1900	90		
March 21, 1900	91		
March 29, 1900	92		2 children.
March 31, 1900	93		
April 5, 1900	94		
April 7, 1900		1 cow.	
April 12, 1900	97		
April 17, 1900	98		
Do.	99		
April 23, 1900	100		Susan Findley and another child. [a]
April 28, 1900	103		1 man and 1 child.
May 10, 1900	105		
May 11, 1900	106		
May 15, 1900	107		
May 23, 1900	111		
May 28, 1900	114		
May 29, 1900	115		1 man.
June 6, 1900		1 horse.	
June 12, 1900	118		
Do.	119		
June 28, 1900	120		1 child.

[a] These children were bitten by a District dog diagnosed by inoculation experiments in Baltimore as rabid.

THE PREVENTION OF TUBERCULOSIS.

Since the discovery of the diagnostic value of tuberculin in bovine tuberculosis in 1891, there have been many official tests made in the United States to ascertain the extent to which the disease exists, and to diminish the number of affected animals. While numerous herds have been found diseased to a remarkable and even alarming extent, the consensus of opinion is that, considering all the cattle in a State, not over 5 per cent of the animals would react to the test even in our dairy sections, and not half of 1 per cent of the cattle killed under the Bureau inspection is found tuberculous. In certain districts, however, the disease is much more frequent, and the astonishing degree to which it may develop in a herd before its presence is discovered by the owner, and much less by others, has led to a demand for investigation and for repressive measures.

A considerable number of States have laws and regulations made for the purpose of preventing the introduction of tuberculous cattle from other States or foreign countries. While these differ much in detail, the general plan is to require that cattle introduced for breeding or dairy purposes be tested with tuberculin and their healthfulness certified by the authorities of the States from which they originate, or, failing in this, by the authorities of the State where they are destined to remain. The weak points in this system are: First, that many States from which cattle are shipped have no officials to make the tests and none with authority to issue certificates; second, that very few of the receiving States have a sufficient veterinary force to make the required tests; and, third, that the numerous and varied requirements of the several States are confusing to shippers, difficult to comply with, and a serious burden to interstate commerce. The situation is not unlike that which existed fifteen years ago, when nearly every State had a quarantine against the cattle of every other State to guard against the introduction of contagious pleuropneumonia.

This Bureau has endeavored to assist the individual States in guarding against infection from other States and from foreign countries, as contemplated by its organic act. Notice has been given that it is a violation of the Federal statutes to ship animals affected with tuberculosis from one State to another. Cattle imported from Canada for breeding or dairy purposes are required to be accompanied by a certificate of healthfulness shown by a tuberculin test made by an official veterinary surgeon, while those from other countries which pass through the quarantine stations are tested during the period of detention.

The certificates of tests made in the country of origin have frequently been unsatisfactory, and it has been determined to make immediate arrangements to have imported cattle tested by officials of this Government. It is thought that the cattle from Great Britain may be tested before they leave that country, and the importers thus saved from the loss which is inevitable if they are tested here.

The effort to control tuberculosis is a most reasonable and proper one, and if conservatively directed should receive the support of every friend of the cattle industry. Not only is tuberculosis one of the worst scourges of the bovine race, attacking as high as 90 per cent of the animals in individual herds, but its existence is believed by the best sanitary authorities to be a serious menace to the health of the consumers of meat and dairy products. It is therefore a disease to be dreaded, not only because of the value of the cattle which it injures or destroys, but because it threatens mankind with an incurable and fatal infection. The individual States, therefore, have good reason for desiring to stop the importation of the tuberculosis contagion and for adopting measures intended to lessen or control the disease within their own territory.

Tuberculosis unfortunately is not confined to cattle, but also affects swine, and in these animals is more acute and more likely to involve the edible portions of the carcass. There is good reason to believe that the disease is becoming more frequent with swine, probably on account of feeding the mixed milk returned from creameries. A single tuberculous herd of cows might in this manner infect the greater part of the swine in a considerable district. While this method of propagating the disease could be easily guarded. against by sterilizing the milk, it appears that this simple precaution is usually neglected.

The herds of the United States are far less seriously affected with tuberculosis than are those of European countries, notwithstanding the fact that none of our States feels able to adopt and enforce systematic and thorough measures for the immediate control of this disease. The proportion of animals affected in Europe indicates both the danger which threatens our herds, if the disease is allowed to progress here, and the importance of thorough measures to prevent the introduction of diseased breeding stock from abroad.

Recent figures from reliable sources show that of 4,256 cattle tested in Moravia, Austria, 1,553, or 36.48 per cent, were tuberculous. The slaughterhouse statistics of Amsterdam show an increase in the percentage of tuberculosis among adult cattle from 1.76 in 1888 to 13 in 1898. In France, according to Nocard and Leclainche, Champagne, Lorraine, and Brie are highly infected, the number of tuberculous cows in some regions reaching 15 to 20 per cent; veterinarians estimate that the proportion of tuberculous cows in Beauce exceeds 25 per cent; in Brittany and Nivernais the disease is making frightful progress; in the Hautes Vosges 30 to 40 per cent of the milch cows are said to be tuberculous, while in the southeast the proportion is greater still, and in certain valleys of the Pyrenees exceeds 50 per cent. In Denmark, of 67,263 cattle tested from 1896 to 1898, 32.8 per cent were found tuberculous. In Belgium 48.88 per cent of cattle reacted out of a total of 20,850 head tested. Recent slaughterhouse statistics from Germany show that the cattle slaughtered are affected with tuberculosis as follows: At Berlin (1897), 20.63 per cent; Magdeburg (1897), 24.1 per cent; Bromberg (1896), 27.6 per cent; Lubeck (1896), 33 per cent; Leipsic (1897), 36.4 per cent; Stolp (1898–99), 37.7 per cent; and in the whole of Saxony (1898), 30.46 per cent.

In Great Britain the investigations have not been so extensive as in some other countries, but according to McFadyean 15,392 head of cattle were tested during three years with tuberculin supplied by the Royal Veterinary College, and of these 4,105, or 26 per cent, reacted. These animals were located in all parts of England, with a few in Ireland, Scotland, Wales, and the Channel Islands. Four veterinary surgeons tested 80 purebred Shorthorns for export, and 34 of these, or 42 per cent, reacted.

These facts show the almost universal distribution and the serious extent to which tuberculosis prevails among the cattle of Europe. We might almost question the advisability of further importations from such badly diseased herds, but certainly if importation is allowed it should be under the strictest supervision and with the adoption of every precaution to prevent violation or evasion of the law which prohibits the importation of diseased animals.

There have been made and distributed during the year 33,400 doses of turberculin, which were supplied to local authorities as a means of cooperation for the suppression of the disease. The greater part of this was used by the States of Minnesota, Vermont, and Illinois, but a considerable quantity was sent to Michigan, Iowa, New Jersey, and California, and a small amount was supplied to the War Department, the Marine-Hospital Service, and to inspectors of the Bureau of Animal Industry for official use. The use of tuberculin as a means of discovering tuberculosis has been less extensive in the United States during the past year than in some previous years, owing, it appears, to a sentiment which has been created against it by those who oppose work for the suppression of this disease. The value of this agent has been thoroughly established by scientific investigation and practical use, and no well-informed veterinarian would at the present day undertake to conduct any effectual operations for eradicating this disease without its aid in selecting the affected animals. While, therefore, certain States may temporarily abandon the use of tuberculin, they are sure to return to its use when they seriously attempt to control the disease, since its aid is indispensable to intelligent and efficient action.

The Bureau has recently made a test of the herd of cattle belonging to the Government Asylum for the Insane, at St. Elizabeth, D. C., which serves as an additional illustration of the great value of tuberculin. The presence of tuberculosis in this herd was revealed accidentally. A number of the dry cows were running in a field, where they were undoubtedly bitten by a rabid dog, as 18 of them died of rabies in the course of two weeks. In making the postmortem examination to discover the cause of death at least 12 of them were found extensively affected with tuberculosis. This led to the entire herd being tested with tuberculin by the Pathological Division of this Bureau. Of the 102 animals tested, 79 gave a decided reaction, making the proportion of animals affected more than 77 per cent. As 13 of the 23 animals which did not react had but recently been purchased from a farm in Virginia, it will be seen that more than 90 per cent of the old herd reacted to the test.

Advantage has been taken of this opportunity to test the ineffectiveness of milk from cows which have reacted to the tuberculin test, but which on physical examination are apparently healthy. A large number of feeding and inoculation experiments are in progress, in which about 700 experimental animals are being used. The results, which will be of great value from a sanitary point of view, will be submitted for publication as soon as the experiments are completed.

GENERAL PATHOLOGICAL INVESTIGATIONS.

During March and April a highly fatal disease appeared among the cattle belonging to the Government Asylum for the Insane, at St. Elizabeth, D. C. Six or seven dry cows died in the course of two days, exhibiting symptoms of gastro-enteritis with cerebral complications. A number of other cows became similarly affected, and in the course of two weeks from the beginning of the outbreak 18 animals had died, when the disease suddenly stopped.

A careful investigation in connection with the history of the presence of a supposedly mad dog among the cattle of the affected herd suggested that the disease might be rabies. This diagnosis was subsequently proven by animal inoculations, and a report is now being prepared covering this investigation.

Caseous lymphadenitis in sheep has been found to be quite prevalent in the United States, but owing to its very chronic course the pathological alterations seldom reach such an extent as to cause death, or even to cause the rejection of the carcasses on postmortem examination. The disease has been observed in Europe, South America, and Australia, and is due to a specific bacillus first described by Preisz in 1891. The results of the investigations made by this Division are published in the Sixteenth Annual Report of the Bureau.

An outbreak of facial dermatitis in sheep occurred on a farm in Maryland about 16 miles east of Washington. The principal symptoms consisted in the formation of thick, warty scabs on the lips and around the nostrils and spreading to a greater or less extent up toward the eyes, sometimes involving the lids and causing severe conjunctivitis. Out of a flock of 142 ewes, 45 head were affected. The disease yields readily to treatment. Abundant material was preserved for an investigation as to the specific cause of the lesions, and this work will be taken up as soon as possible.

An investigation of an infectious disease among a flock of sheep in Michigan was based upon material sent to the Division by Drs. Ackerson and Klopfenstein, of Manchester, Mich., for diagnosis. It consisted of a bottle of blood obtained immediately after death from one of the affected animals, and was accompanied by postmortem notes which suggested that the disease in question might possibly be anthrax. An examination of cover-glass preparations made from the blood showed it to contain, in apparently pure cultures, a short spore-bearing bacillus, which morphologically differed from any of the common spore-bearing pathogenic bacteria. The possibility of the disease being braxy, or bradsot, a fatal infectious sheep disease, common in Norway and Scotland, at once suggested itself. That this supposition was correct has since been fully demonstrated, and a paper on this subject is now being prepared for publication.

Two outbreaks of gangrenous vulvitis in cattle were reported during the fiscal year and specimens forwarded to the Division for examination. A short motile aerobic bacillus was isolated from the deeper parts of the lesions, which, on injection on smaller experiment animals, produced similar lesions. Inoculations on sheep and calves failed to give positive results. The investigation will be continued as soon as fresh material can be obtained.

The investigation regarding the therapeutic value of the so-called gasoline treatment for parasitic diseases in sheep has embraced only the treatment of a single flock, consisting of 89 head, the majority of which showed unmistakable symptoms of bronchial and intestinal helminthiasis. The results, which were very encouraging, will be referred to the Zoological Division for publication, as the pressure of work in the Pathological Division has not allowed of the continuation of this investigation.

It appears that infectious abortion in cattle is constantly spreading among the dairy herds of the United States, and numerous outbreaks have been reported during the past fiscal year. In each case the method of sanitation and prevention as suggested by Professor Bang, of Denmark, has been recommended, but sufficient time has not yet elapsed to allow of any conclusions being drawn from the results obtained. The disease is caused by a specific bacillus, pure cultures of which have been obtained from an outbreak among the cattle at St. Elizabeth, D. C. The disease is highly interesting; and as the possibility of finding a vaccine or preventive serum for this disease has been suggested by Professor Bang, the further investigation of the specific bacillus will be continued in the Pathological Division.

A great number of pathological specimens have been referred to the Division for diagnosis. These have been received from members of the meat-inspection force of the Bureau of Animal Industry, from various State sanitary officials, from practicing veterinarians, or from private parties. In each case a histological and bacteriological examination has been made and the inquirer informed of the results.

THE EXPERIMENT STATION OF THE BUREAU.

The experiment station has cooperated with the other divisions in their experimental investigations, by which it has been conclusively determined that the best animals to use for the production of hog cholera and swine plague antitoxic serum are cattle, mainly because of their considerable immunity from inflammatory processes of the kind which are produced in other animals when the cultures of living hog cholera and swine plague germs are injected under the skin. The serum obtained from horses, mules, and donkeys is fully as potent as that from cattle, but can be produced only at a much greater cost.

The antitoxin animals during the year supplied about 1,500,000 cubic centimeters of blood, which was delivered to the Biochemic Laboratory, where the serum was collected and prepared for distribution.

A serum for the prevention of the disease known as tetanus, or lockjaw, is being prepared and will soon be ready for use. The exercise of the greatest care does not prevent an occasional outbreak of tetanus among antitoxin animals unless measures are taken to make the animals immune from the affection. A perfectly satisfactory immunity is produced by periodic injections of tetanus antitoxic serum.

TEXAS FEVER.

The work on Texas fever has been of two kinds: First, that directly concerning the disease; and, second, that concerning the destruction of the Southern cattle tick.

In a previous year a number of cattle ticks (*Boophilus annulatus*) were received from Porto Rico and tested as to their infectious character. Two Northern cattle were exposed to them and seemingly escaped having an attack of Texas fever. During the year just ended two cows and a calf were received from Porto Rico. Blood was drawn from the jugular veins of the cows and injected under the skin of two Northern cows susceptible to Texas fever. The result was that the two Northern cows became affected with the disease. One died and the other is now making a slow recovery. This shows conclusively that Texas fever exists in the island of Porto Rico, and very probably in other portions of the West Indies.

The two cattle which were exposed in a previous year to ticks received from Porto Rico, seemingly without suffering an attack of Texas fever, were turned into a field during the year just ended with several other cattle and infected with noninfectious ticks. When the noninfectious ticks had matured and dropped to the ground, and eggs had been produced and hatched, and the new crop of young ticks began to appear on the cattle, several cases of fatal Texas fever developed. The two animals previously exposed to Porto Rican ticks remained unaffected. From this we may draw two conclusions: First, that the cattle exposed to Porto Rican ticks suffered an attack of Texas fever too mild to be diagnosed as the result of the exposure; and, second, that the mild disease was sufficient to produce such changes in their blood that they were capable later on of reinfecting noninfectious ticks with an infection sufficiently virulent to cause fatal Texas fever. The ticks referred to as Porto Rican ticks are identical with the well-known Southern cattle tick. A further report on this subject will be presented at another time.

A number of other experiments concerning Texas fever were planned for the year, but could not be made because of the lack of space and time at the station.

The Southern cattle tick dip question remains without a wholly satisfactory solution. Many dips were tested during the year and were found to be unsatisfactory. The dips either do not kill the ticks or affect the cattle too severely to be of practical value. The ticks show a wonderful resistance to adverse conditions which is entirely out of proportion with their small size. Among the dips tested, the best results were obtained from the so-called Australian dip, which has the following formula:

Stockholm tar	gallons..	7½
Carbonate of soda	pounds..	23
White arsenic	do....	8

Water sufficient to make 400 gallons.

This dip is objectionable because of the arsenic which it contains and because it is necessary to dip an animal twice before all the ticks are killed. From the first dipping the cattle do not seem to suffer much, but as a result of the second dipping it has been frequently noticed that they refuse food for several days, act generally depressed, and have a more or less severe diarrhea. The same dip without arsenic at one trial gave very encouraging results, but when tried again, prepared with tar from another barrel, it proved to be almost without effect on the ticks.

A number of modifications of the Australian dip have also been tried, such as an increase in the amount of tar, the substitution of North Carolina tar for Stockholm tar, the substitution of other alkalies for the carbonate of soda, the addition of soap, etc. No better results were obtained. The addition of soap to the Australian dip containing arsenic killed practically all the ticks, but also killed two of the three cattle dipped. Dips containing as the main ingredients carbolic acid, tobacco extract, oil, sodium sulphate, glycerine, lime, and sulphur, and numerous other substances, either singly or in combination, have been tried and found to be unsatisfactory. This work is still in progress and will be continued. Possibly something may be done by combining a dip with a drench containing substances which will act on the tick through the secretions of the skin of the cattle.

THE DAIRY DIVISION.

The general survey of the condition of the dairy industry of the United States, begun upon the organization of the Dairy Division, has been continued, and special inquiries have been made along lines such as the milk supply of cities and towns and the development of foreign markets for our butter. Some reports have been issued and others are nearing completion.

The routine work of the office, including preparation of manuscripts for publication and replying to the requests for specific information from many correspondents, is constantly increasing. The publications of the Division during the year number five, comprising in all 183 pages. One was issued as a bulletin, one as a circular, one as a paper in the last Yearbook of the Department, and two as papers in the Fifteenth Annual Report of the Bureau. Correspondence on all subjects connected with dairying is sometimes so heavy as to greatly retard the other important work with which the office is charged. Some inquiries have recently been received concerning the dairy possibilities in the islands which have lately come under the control of this country.

During the year a detailed report was prepared upon the series of experimental shipments of dairy products to European markets, which were made under special authority given in the acts of Congress making annual appropriation for this Department.

In the latter part of the year experimental shipments to Europe were again inaugurated, special efforts being made in connection with the Department exhibit at the Paris Exposition to show the high quality of our dairy products.

A number of experimental shipments of butter, cheese, and cream have also been forwarded to trans-Pacific points, which had been visited and selected by a special agent of the Department. On account of the great distance and the failure of some of the consignees at first fully to understand the purposes of the Department's efforts, it is not yet possible to make a report on these shipments.

The chief and assistant chief of the Division have visited dairy centers in fifteen different States and attended the annual meetings of State dairy associations and similar bodies in ten of these States. It has thus been possible to meet and consult with many persons actively engaged in the dairy industry in different parts of the country and to learn their needs, and personal relations have been established which will be of material benefit in future work. No special agents for representing the Department at important dairy meetings which the officers of the Division could not attend were employed during the past year, as had been the practice during previous years.

Arrangements were made in the Dairy Division for the United States exhibit of animal industries at the Paris Exposition. The chief of the Division took personal charge of the preparation of the various exhibits, which were planned to show, by photographs, models, mechanical devices, raw materials, and finished products, the development and present condition of the different branches of the live stock industry.

The plan of the work of the Dairy Division for the fiscal year 1900–1901 includes a continuation of the different lines of work above reported.

Much valuable information concerning dairying in foreign countries had been received in the numerous reports from consuls, which were secured through the courtesy of the State Department, and it is proposed to prepare these reports for publication as soon as the more pressing work of the Division permits.

Attention to the many details in connection with the experimental exports requires a large share of the time of the working force of the office. Shipments of butter to Cuba and Porto Rico have been begun. In these experiments we are confronted with problems quite similar to those met in the shipments from San Francisco to the Orient. The dairy products are forwarded to warm countries, shipment has to be made without refrigeration, and cold storage is not available at the points of destination. It is necessary, therefore, to send butter, and perhaps cheese, as well as condensed milk and cream, in hermetically sealed packages, which afford the best means known of preserving such perishable products. It is hoped to obtain information useful to butter exporters in connection with the most important subjects of canning butter and producing butter which has a hard body that will stand up better than even much of the high-grade butter marketed in this country. Experiments are now in progress at some of the State stations to determine the causes affecting the body of butter, and the results of these are awaited with interest by all who are engaged in foreign trade. Some countries sending butter in cans to these new markets supply a product with a very high melting point, showing in this, as in other ways, a disposition to adapt their products to the needs of these countries, an example our producers must follow if they are to compete successfully in these markets. The experimental shipments of the Dairy Division will be directed to showing our producers what needs to be done.

It is proposed to ascertain the prospects for trade in dairy products in the South American countries besides those already named.

Reports from the Paris Exposition show that the products of American dairies, creameries, and cheese factories have won a large number of high honors. A detailed report upon the dairy features of the exposition will be made later by the chief of the Division.

The Dairy Division is arranging to make a suitable exhibit at the Pan-American Exposition in Buffalo. It will be in the nature of an object lesson, illustrating the wonderful development of this branch of agriculture.

It is considered extremely desirable that the existing system of Government inspection and certification of meats and meat products for export be extended, by additional legislation, so as to include butter, cheese, and condensed milk and cream for export from the United States. Reasons for such legislation have been stated in previous reports, and they apply now even more forcefully than when first given. Briefly, a few of the arguments for such new legislation are as follows:

Foreign buyers of dairy products have so often been deceived by misleading and sometimes false statements, claiming that shipments of dairy products are high grade when really they are inferior, or in part inferior, that many of them suspect all products exported from this country, and avoid them whenever it is possible to supply their needs elsewhere. In this way we have recently lost a fine market in Great Britain for our cheese.

The Department has expended much labor and money to establish a reputation abroad for American dairy products, and already the good results accomplished are being counteracted by the shipment of inferior goods which are claimed to be of high quality. After the buyers on the other side have been defrauded a few times by such shipments, they will be unwilling to deal with us when it can be avoided.

Other countries have developed large foreign trade in their dairy products, and it is well known that one of the principal reasons for their rapid advance in the largest markets of the world is the fact that their best products are marked with a Government stamp, showing conclusively that the article is as represented.

The proposition to inspect dairy products for export has been indorsed by nearly all of the large conventions of representative dairymen in this country, and it has the decided approval of commercial bodies and individual exporters. So far as this office is aware, no objection to it has been made.

Legislation by which the Department shall be given supervision of oleomargarine and filled cheese when offered for export, and perhaps also of the movement of these commodities in interstate commerce after having been taxed and stamped under the regulations of the Treasury Department, seems advisable. These are food products, mainly of animal origin, and the duty of seeing that they maintain their true character when entering interstate and foreign commerce may properly be placed upon this Department. It is easily understood that the spirit of the oleomargarine and filled cheese laws requires something more than their administration simply as revenue measures; and it is evident that the interests of consumers and producers of pure dairy products, and their imitations, and of honest dealers in all, would be greatly conserved by giving the Department authority to prevent one from being substituted for the other, and to compel all to be sold under their true names and free from deception on the part of those who handle them.

THE FREE DISTRIBUTION OF BLACKLEG VACCINE

What has been accomplished by this means; the necessity for its continuance; the actual cost of its preparation and distribution.

By Victor A. Nörgaard, V. S. (Copenhagen),
Chief of Pathological Division, Bureau of Animal Industry.

During the fiscal year ended June 30, 1900, there were prepared in the Pathological Division of the Bureau of Animal Industry 1,076,150 doses of blackleg vaccine, which were distributed among 6,142 applicants located in 40 States and Territories. On an average, each applicant received about 175 doses. Below will be found an itemized account of the number of doses sent to each State and Territory:

Number of doses of blackleg vaccine distributed during fiscal year ended June 30, 1900, by States.

Arizona	3,750	Nevada	1,390
Arkansas	420	North Carolina	3,315
California	8,585	North Dakota	76,325
Colorado	99,340	Ohio	60
Georgia	20	Oklahoma	42,085
Idaho	4,595	Oregon	6,655
Illinois	1,535	Pennsylvania	2,045
Indiana	600	Philippine Islands	50
Indian Territory	28,495	South Dakota	91,575
Iowa	13,325	Tennessee	1,970
Kansas	172,535	Texas	189,235
Kentucky	4,235	Utah	6,725
Louisiana	75	Vermont	410
Michigan	170	Virginia	19,190
Minnesota	13,835	West Indies	500
Mississippi	340	Washington	2,615
Missouri	19,420	West Virginia	2,770
Montana	23,560	Wisconsin	540
Nebraska	185,580	Wyoming	38,600
New Mexico	9,215		
New York	465	Total	1,076,150

The above table illustrates fairly well the extent to which blackleg prevails in the respective States and Territories, as it may be presumed that most vaccine is sent where the disease is most prevalent. Consequently, the worst infected region is the vast area between the Mississippi River on the east and the Rocky Mountains on the west, and extending from Canada to the Gulf of Mexico. Of the Eastern States, Virginia seems to be the only one where the disease prevails to any considerable extent, though scattered outbreaks are reported from a majority of them.

That blackleg is on the increase all the time can not be doubted, and abundant testimony is at hand to show that the losses would be appalling if it were not for vaccination. This increase in mortality from a disease which must have prevailed for generations is without doubt due to the differentiation of the various breeds, and the grading-up of the vast herds of hardy, half-wild cattle. The buffalo, for instance, was undoubtedly immune from blackleg, while the longhorns, which a few years ago formed the great majority of the herds of the West, possessed great powers of resistance to it. For this reason the disease was of minor importance ten years ago, although there is evidence of its repeated appearance at longer or shorter intervals among the herds in various parts of the country. The losses, however, were looked upon as unavoidable and did not in magnitude compare with the losses which nowadays may befall the cattle owner in the infected districts who neglects to protect his high-grade and full-blooded stock against this disease.

The recrudescence of blackleg dates back to the time when the stockmen began to improve the native breeds with strains of purebred cattle, and, as the long-legged, long-horned, far-roaming beasts gradually became transformed into the deep-chested, beefy, and more indolent cattle of the present day, there also occurred a gradual retrogression in the vitality and in that power of resistance to diseases which characterized the native stock. In certain sections of the country, where the disease had been practically unknown or where it occurred only at intervals of two, three, or four years, it gradually became more and more prevalent until, at the present time, it has become of daily occurrence.

The problem of mastering blackleg is, however, not a hopeless undertaking, although it may require some time; for as each succeeding generation attains higher physical development it likewise adapts itself to its surroundings, and through constant exposure becomes more and more resistant to the infection. It is therefore simply a question of time when the high-grade and thoroughbred cattle will attain the same degree of immunity from blackleg which now characterizes the fast-disappearing longhorns. But woe to the stock owner who is satisfied to wait for this, and who does not bestir himself while waiting; for where blackleg once claimed 1 or 2 per cent of the common cattle, it now frequently takes 10, 25, or even 50 per cent of the unvaccinated high-grade or thoroughbred herd. A glance at the table below shows that out of the 1,980 herds considered in this report not less than 15,786 head died from blackleg simply because the respective owners postponed vaccinating until the disease actually appeared.

What the loss would have been in case vaccination had not been resorted to can only be surmised, but a careful compilation of estimates furnished by reliable stockmen in each county places the figures at about 12 per cent of all young stock in the infected districts. This would have meant a loss of about 44,000 head out of the 369,258 animals vaccinated, whereas the actual loss after vaccination amounted to 2,547 head only, or 0.69 per cent. If we deduct from this total the number of deaths which occurred immediately after vaccination (that is, within forty-eight hours), and also those which were admittedly due to mistakes in preparing or injecting the vaccine, we find that only 2,051 head, or 0.55 per cent, died on account of failure of the vaccine to protect them against the disease. (See table on p. 41.)

Table showing the number of cattle vaccinated and the percentage of loss before and after vaccination.

State.	Number of reports.	Number of cattle vaccinated.	Per cent of estimated annual loss from blackleg.	Deaths same season, but previous to vaccination.		Died after vaccination.					
				Number.	Per cent.	Within 48 hours.	From 2 to 7 days after.	Within 1 year.	Number of cases admitted to be due to mistakes.	Total number.	Per cent.
Arizona	11	1,660	15	95	5.7	5	7	15	0	27	1.65
California	19	3,010	21	113	3.7	1	0	19	1	21	.66
Colorado	250	47,180	13	1,624	3.4	26	58	127	18	205	.43
Idaho	11	1,716	12	126	7.4	1	0	4	0	5	.30
Indian Territory	62	30,326	14.5	2,503	8.3	18	15	71	5	109	.37
Iowa	17	1,059	8.3	66	9	0	2	0	0	2	.19
Kansas	385	67,259	10.5	2,360	3.5	93	49	352	55	549	.82
Missouri	38	8,588	9.5	370	8.9	2	3	52	1	58	.68
New Mexico	28	4,802	11.2	222	4.6	2	5	48	4	59	1.12
Nebraska	360	58,945	14.5	1,716	3	39	60	431	31	561	.93
North Dakota	95	13,527	14	1,033	7.6	18	17	38	9	82	.60
Oklahoma	136	24,195	12.4	955	3.9	18	13	84	12	127	.48
South Dakota	174	17,108	14.8	751	4.4	13	10	85	5	113	.59
Texas	231	64,000	12.6	1,966	9.3	47	45	264	50	406	.63
Utah	11	2,976	10	150	5	3	0	10	0	13	.43
Virginia	54	3,190	10	170	5.3	0	4	26	6	36	1.12
West Virginia	13	894	10	71	7.9	0	0	1	0	1	.12
Wyoming	35	13,710	15	1,162	8.5	2	4	117	6	129	.94
Other States	41	4,069	10.1	238	8	4	2	5	1	12	.30
Total	1,980	369,258	12.07	15,768	4.84	292	298	1,753	204	2,547	.69

From this table it will be seen that 1,980 cattle owners vaccinated 369,258 head of stock, or an average of 186 head each. They estimate that without any vaccination their loss from blackleg would have amounted to over 12 per cent of all young stock. This figure, which no doubt is too low, if we consider the present prevalence of the disease, has been arrived at by adding the estimated loss given by every applicant for vaccine, by States, and dividing the sum by the number of the applicants, and obtaining the percentage. The resulting figures are those appearing in the column headed "Per cent of estimated annual loss from blackleg." By applying the estimated average percentage of loss for each State to the number of cattle vaccinated in that State, we obtain the approximate number of cattle which would have died out of the total number vaccinated in case this precaution had not been taken, and the result is 12 per cent. This figure is, no doubt, a conservative one when it is taken into consideration that a great majority of ranchmen (and they are the ones chiefly concerned in the blackleg question) rarely or ever succeed in raising 75 per cent of their increase, and that it is generally conceded that the loss from blackleg alone exceeds that of all other causes combined. The recorded loss of 15,768 out of 369,258 head, or 4.84 per cent, as a result of not vaccinating in time, would also indicate that the estimated loss without vaccination is far from being exaggerated.

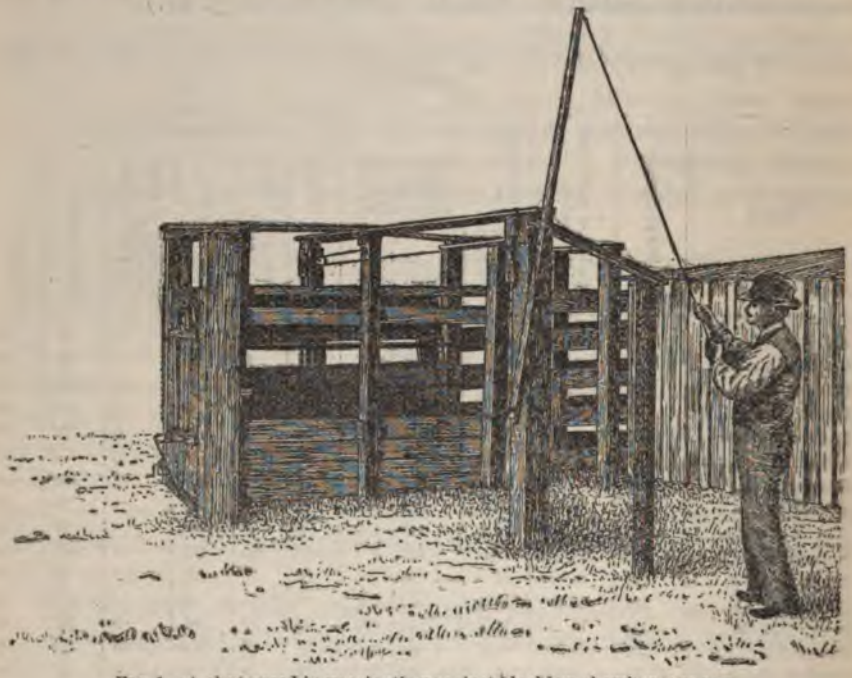

FIG. 1.—A chute used in vaccinating against blackleg, showing squeezer.

After vaccination 292 head died within forty-eight hours. All of these animals were undoubtedly infected previous to vaccination, as it would not be possible for them to develop the disease and die from it within that space of time. Numerous inoculations of calves with large doses of highly virulent blackleg virus have demonstrated that forty-eight hours rarely suffices for the development of a fatal case of blackleg, and the conclusion is justified, therefore, that the animals affected on the range, and which receive only an infinitesimal amount of virus through a puncture or scratch of the skin, require a longer time of incubation than the experiment animals, regarding which there is no uncertainty as to either the amount or the virulency of the injected material. For this reason the 292 head in question should not be counted in estimating the merits of the vaccine.

Two hundred and ninety-eight head died in from two to seven days after vaccination. In a number of these cases the owners report that the blackleg swelling did not develop at the place of injection, but on either the opposite shoulder, the brisket, chest, rump, or thigh. Although such cases could not possibly be ascribed to the effect of excessively strong vaccine, it has been thought best to count all the cases which developed within the above-mentioned period as being due to a lack of resistance on the part of the animals, resulting in the development of typical blackleg from the injection of the vaccine. These losses can not possibly be guarded against, and are not due to any defect in the preparation of the vaccine, but, as stated, to an individual idiosyncrasy or hypersusceptibility on the part of the animals in question. If the vaccine was to be attenuated to such a degree that none of these cases would occur, its immunizing properties would be reduced

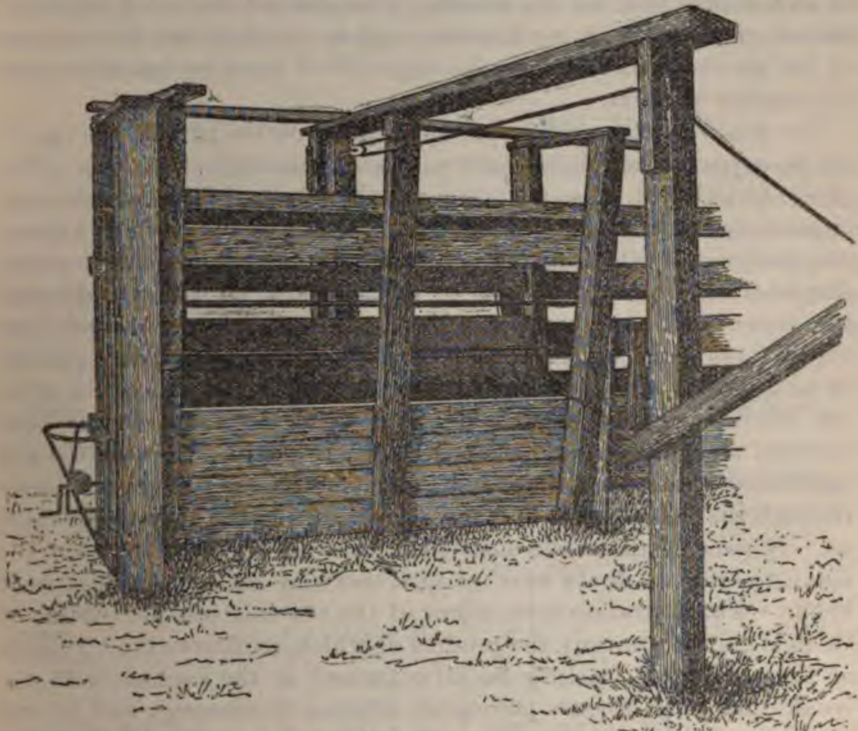

FIG. 2.—Another view of a chute used in vaccinating against blackleg, showing squeezer.

to a point where it would not protect 50 per cent of the vaccinated animals. But fortunately these cases are rare and amount only to one animal in every 1,240 head vaccinated. On the other hand, two or three cases may occur in a small herd of less than 50 head, while none may be seen after vaccinating a herd of several thousand head with identically the same vaccine.

Within one year from the date of vaccination 1,753 animals died. The greater majority of these are supposed to have died from blackleg, but in numerous cases they are simply reported as lost. It is, of course, impossible on large ranches to ascertain the exact cause of death in each animal lost, but, as blackleg is considered the chief source of loss of young stock, it is reasonably safe to conclude that in a number of the above-mentioned cases the diagnosis of blackleg has been made as a matter of habit.

The losses due to carelessness or mistakes on the part of the operator in preparing and injecting the vaccine amount to 204 cases. The great majority of these mistakes are the result of simultaneous vaccination and castration. It seems that, in spite of the warning repeatedly sent out by this Bureau, and which invariably accompanies each shipment of vaccine, a number of cattle owners persist in continuing the above-mentioned practice. From personal observations and from verbal reports the writer is led to believe that this practice is carried on to a greater extent by far than appears to be the case in the written reports received at this office. Reliable information has been received regarding a number of cases where the owners castrated and vaccinated at the same time, and subsequently suffered severe losses through the development of blackleg swellings in the regions operated on. In none of the above-mentioned cases did the owners report the results, as they no doubt were satisfied that they had only themselves to blame. The castration sores admit of the entrance into the system of various microorganisms, the product of which reinforces the virulence of the attenuated blackleg bacilli contained in the vaccine, with the result that they become pathogenic (disease producing), and typical blackleg swellings develop where these germs are most abundant, that is, around the sores.

It is, of course, not to be expected that stockmen or their employees who vaccinate for the first time should be able to avoid all mistakes or should be so expert in the preparation and injection of the vaccine as those that have had the experience of several seasons' vaccinations, amounting perhaps to thousands of head operated upon. Nevertheless, on the basis of the reported mistakes, the directions for use have gradually been perfected until few mistakes are possible for those who exercise diligence and care in familiarizing themselves with the information forwarded to them—that is, with the subject-matter of Circular No. 31 of the Bureau of Animal Industry, entitled "Blackleg: Its Nature, Cause, and Prevention," as well as with Circular No. 23, entitled "Directions for the Use of Blackleg Vaccine"—for it is a notorious fact that a number of applicants for vaccine do not even take the trouble to ascertain what ages of cattle are to be vaccinated, but request vaccine for all cattle, from newborn calves to aged bulls and cows, while others, after receiving the vaccine, content themselves with the reading of the synopsis of the directions, as given on page 8 of Circular No. 23, and subsequently write letters asking for information which is contained in the two circulars.

In spite of this the number of cattle reported lost on account of acknowledged mistakes is a very small one, and no doubt a goodly percentage of the losses shown under other heads could be classified in the former column had the owners realized or chosen to acknowledge their mistakes.

PREVENTIVE EFFECT OF THE BUREAU VACCINE.

In estimating the merits of the Bureau vaccine as a preventive against blackleg we are, in view of the above, justified in deducting from the total number lost after vaccination those which died within forty-eight hours after the injection and those which were admittedly due to mistakes. The total of 2,547 deaths after vaccination thereby becomes reduced to 2,051, and the percentage of loss falls from 0.69 to 0.55, or a little more than one-half of 1 per cent.

Table illustrating the actual merit of the Bureau vaccine as a preventive of blackleg.

State.	Number of reports.	Number of cattle vaccinated.	Per cent of estimated annual loss from blackleg.	Deaths same season previous to vaccination.		Died after vaccination.			
				Number.	Per cent.	From 2-7 days after.	Within 1 year.	Total number.	Per cent.
Arizona	11	1,660	15	95	5.7	7	15	22	1.33
California	19	3,010	21	113	3.7	0	19	19	.63
Colorado	250	47,180	13	1,624	3.4	58	1 7	185	.39
Idaho	11	1,716	12	126	7.4	0	4	4	.24
Indian Territory	62	30,326	14.5	2,503	8.3	15	71	86	.25
Iowa	17	1,059	8.3	66	9	2	0	2	.19
Kansas	385	67,259	10.5	2,360	3.5	49	352	401	.59
Missouri	38	8,588	9.5	370	8.9	3	52	55	.64
New Mexico	28	4,802	11.2	222	4.6	5	48	53	1.10
Nebraska	360	58,945	14.5	1,716	3	60	431	491	.83
North Dakota	95	13,527	14	1,033	7.6	17	38	55	.41
Oklahoma	136	24,195	12.4	955	3.9	13	84	97	.40
South Dakota	174	17,108	14.8	751	4.4	10	85	95	.55
Texas	231	64,000	12.6	1,966	9.3	45	264	309	.60
Utah	11	2,976	10	150	5	0	10	10	.34
Virginia	54	3,190	10	170	5.3	4	26	30	.93
West Virginia	13	894	10	71	7.9	0	1	1	.12
Wyoming	35	13,710	15	1,162	8.5	4	117	121	.88
Other States	41	4,069	10.1	238	8	2	5	7	.91
Total	1,980	369,258	12.07	15,768	4.84	298	1,783	2,051	.55

EDUCATION OF CATTLEMEN CONCERNING BLACKLEG AND ITS PREVENTION.

Five or six years ago but very little was known in this country regarding the nature and cause of blackleg. This statement applies with equal force to the farmer and cattle raiser whose animals died with this disease, as well as to the practicing veterinarian. The very acute course and invariably fatal result of the disease rarely or ever warranted the sending for a veterinarian when an animal became affected, and preventive and curative measures were therefore limited to antiquated household remedies applied in a half-hearted manner, as experience has demonstrated, even to the users, their futility in more than 99 per cent of all cases.

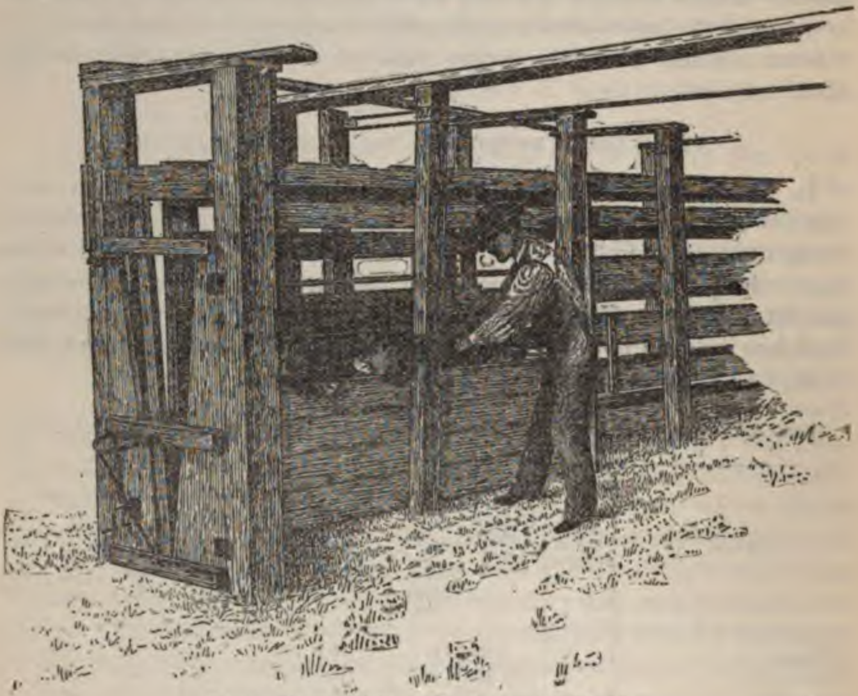

FIG. 3.—Chute used in vaccinating against blackleg.

In 1895 the writer received instructions from the chief of this Bureau to investigate the prevalence of blackleg in Texas and, incidentally, to test the Arloing method of double vaccination. This investigation, the results of which were published in a former article, led to the final introduction in the early part of 1897, by the Bureau of Animal Industry, of the single vaccine method of prevention, which has been named for Professor Kitt. Single vaccine could not be obtained in this country at that time, and therefore this Bureau began to manufacture and distribute the vaccine experimentally. The principal object of this step, however, was to obtain information regarding the prevalence of blackleg in various parts of the United States and to instruct the cattle raiser how to recognize the disease and how to contend with it. For this purpose there have been distributed throughout the cattle-raising States tens of thousands of circulars and reports, comprising more than 3,000,000 pages of printed matter, until at the present day it is doubtful whether there is a single cattle owner in the infected districts who is not familiar with the disease and knows how to prevent it. This result certainly could never have been obtained in the short time of five years had it not been for the free distribution of blackleg vaccine; for it is one thing to furnish this information, but quite another to get the cattle raiser to familiarize himself with it.

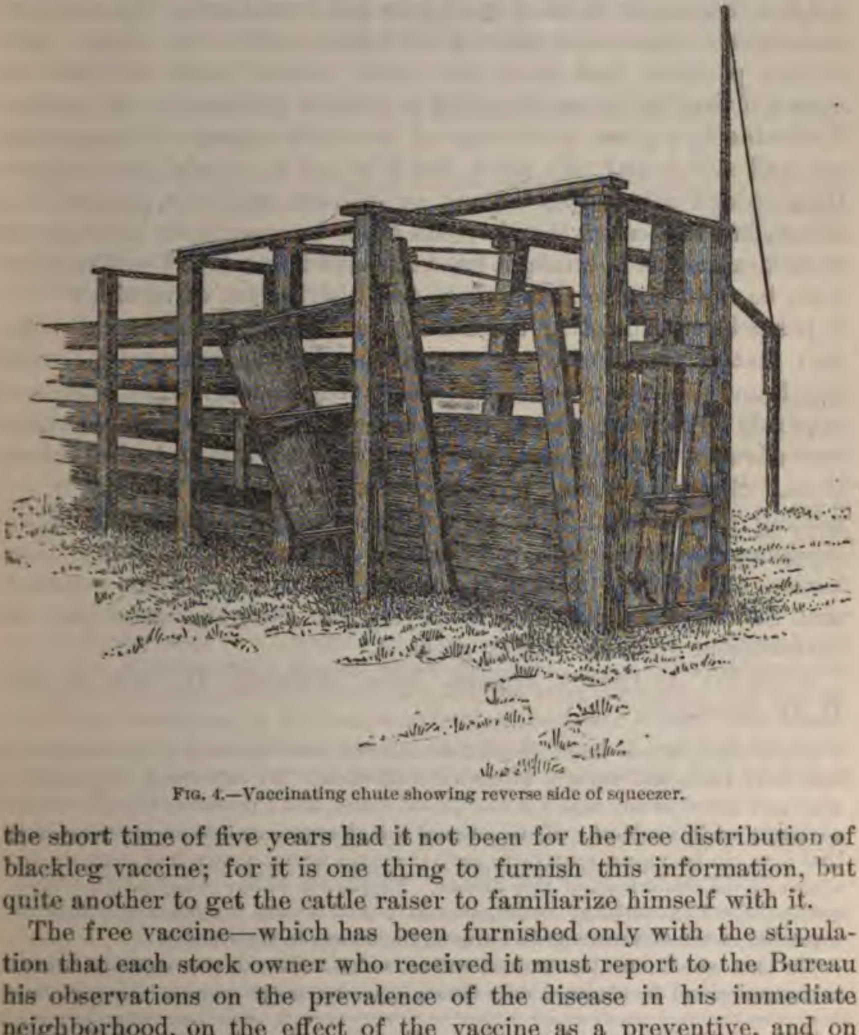

FIG. 4.—Vaccinating chute showing reverse side of squeezer.

The free vaccine—which has been furnished only with the stipulation that each stock owner who received it must report to the Bureau his observations on the prevalence of the disease in his immediate neighborhood, on the effect of the vaccine as a preventive, and on numerous other questions—has made it obligatory for him to familiarize himself thoroughly with the information on this subject furnished by the Bureau of Animal Industry.

Through this source alone the cattle raisers of this country have been educated on the nature and prevention of a disease which undoubtedly ranks as the worst enemy to the cattle industry ever known, and as a result thereof thousands of cattle raisers who would never have paid one cent for any remedy offered for sale as a preventive of it are now vaccinating their herds as regularly as they round up their cattle and wean and brand their calves. Still there are many others who do not send for the vaccine in time, but continue to postpone doing so until their cattle are dying with blackleg. As previously stated, not less than 15,786 head of stock were lost by cattlemen who neglected to vaccinate in time and who reported the results to this office. Does it seem probable that these same cattle raisers would vaccinate any sooner if they had to pay from 12½ to 15 cents per dose for the vaccine? Undoubtedly a great percentage of the cattle raisers of this country are well able to pay this price, but it is just as certain that there are thousands of others who can not or will not pay for a preventive in which, in many cases, they have no faith, because there is no way for them to ascertain how long it has been kept in stock. Would it, therefore, be right now to abandon the free distribution of vaccine?

It has been claimed by those who are opposed to the free distribution that if the vaccine was not given away the cattle raisers would buy it and use it to the same extent as they do now. This statement is purely hypothetic, and to argue against it would be futile, as those who advance that argument would not accept the most logical conclusions. Some light may, however, be thrown on the subject by submitting the opinions held by a number of prominent and reliable stockmen who have expressed themselves in regard to the free distribution of blackleg vaccine, and a number of whom state positively that they have no objection to paying for their vaccine if only the Government guaranty will be given it.[1]

From W. A. Paxton, Omaha, Nebr., February 19, 1900, to Hon. D. H. Mercer:

> I have been, as you know, identified with the cattle interests of this country for over forty years, and am still identified with them. My experience is probably as wide and varied as any man's in the United States, and I therefore think I can write advisedly on this subject. My experience and observations lead me to believe firmly that it would be a great mistake to have the Government at this time discontinue its efforts in the eradication of this disease. People are to-day using the Government vaccine who I am satisfied would never have used it were it not through the instrumentality of the Government in bringing the matter to their notice.
>
> The data which must be obtained and on which is based a thorough and scientific investigation can be obtained only through governmental sources. Most cattlemen

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[1] The letters here quoted have been edited in such a way as to omit direct references to commercial vaccine companies and their agents and distributers, as well as to comparisons between the preventive effect of the Government vaccine and other vaccines specified by name.

would not at all object to paying the commercial price for this vaccine if they were satisfied they had the guaranty which the Government impliedly gives to the vaccine sent out through its Bureau of Animal Industry.

From William P. Wagner, Madison, Kans., February 14, 1900, to Hon. J. M. Miller, M. C.:

I have now been using the Government vaccine for two years, and I am of the opinion that so long as it can be obtained from the Bureau of Animal Industry it will be used as a preventive; but if people have to pay from 15 to 25 cents per dose they will not use it until some of their cattle have died, and sometimes they do not use it then. I think that if the Bureau is allowed to continue the free distribution and thus encourage the stockmen to use it they will eventually stamp out the disease. Were it not for the Bureau vaccine the cattle-raising business would be about paralyzed.

From M. J. Gray, St. Anthony, Idaho, February 11, 1900, to Senator George L. Shoup:

I was the first to use the Government vaccine in this section, and it is now being used successfully in this part of the State. I would never have thought of sending to druggists or other parties for this vaccine, but when my attention was called by the Department to the use of blackleg vaccine I felt, with many others, that we could use this remedy coming from the Government with perfect safety.

From P. F. McClure, president Pierre National Bank, Pierre, S. Dak., February 12, 1900, to Hon. Charles H. Burke:

I have used about 400 doses of this vaccine in treating my own herd of cattle, and with remarkable success in the way of preventing the dread disease. Further, I may say that up to that time, doubtful as to the efficacy of blackleg vaccination, I should not have made the experiment but for the free distribution of the vaccine by the Bureau. I think I was the first stock owner in this locality to ask the Bureau for an experimental supply of vaccine; but the success of my using it led a great many stockmen of my acquaintance to apply to the Bureau for the vaccine, to the end that thousands of doses have been sent to the stockmen on the ranges west of us as well as to cattlemen in this immediate vicinity, and always, so far as my knowledge goes, with the result that a skeptic has been converted into a firm believer in the vaccination of young cattle as a preventive of blackleg. I am quite confident, too, that most of our stockmen could have been induced to try the vaccine only through a gratuitous distribution in the manner adopted by Secretary Wilson. His Department has saved to the ranges and country adjacent to Pierre at least $100,000 worth of cattle, and I, for one, sincerely hope that he will continue the good work he is doing in this direction.

From John M. Adams, owner of Grassmere Horse and Cattle Ranch, Potter, Nebr., February 10, 1900, to Senator John M. Thurston:

It is only through the efforts of the Department of Agriculture that the parties most interested in checking, controlling, and eradicating this fatal disease are beginning to be able to treat it advisedly, and with some hopes of ultimate success. Since the Department three years ago began to distribute this vaccine it has become much more generally used than it ever could or would have been had it alone been controlled by private enterprises. Under the directions and with the benefit of the researches and experiments of the said Department the vaccine is being used much more intelligently and effectively than it would have been under any other circumstances. As we are the beneficiaries, through the Department of Agriculture, of compiled reports on the results of the use of this vaccine, as well as a great deal of valuable statistics regarding this disease which we could not otherwise have obtained, you can readily see how important it is to the cattle industry that the present practice of the Department be continued. Under the sole disposal of private enterprises I am sure that vaccination for blackleg would never have become general and the disease would have been constantly on the increase, with little or no hope of it ever being eradicated; and with the limited amount of general and specific information upon the use of the vaccine and its recorded results we would have continued to grope in the dark, blindly pinning our faith to the assertion of the private enterprises that the vaccine is an absolute specific, although we are so often confronted with the painful fact that in many cases it does not stop the disease or prevent subsequent loss of cattle. Even if this vaccine were all that it is claimed to be, there is still much to be ascertained relative to its use and application, and the public needs to be educated in everything pertinent to the disease, etc., which the Department, and not private enterprise, is now doing. That the free distribution is and has been to a large extent an experiment I firmly believe, and I am equally certain that there is much to be discovered which no individual stock owner is qualified to do for himself before we will have absolute knowledge of this disease or an absolute specific for it. It is but proper that the Government should make these researches and experiments and give the stock interests of the country the benefit of them, and I do not see how it can be successfully done unless the Department of Agriculture continues to furnish free vaccine, receive reports of its use from each individual, together with all the facts pertinent to the disease and its prevention.

From Dr. Robert H. Treacy, State veterinarian of North Dakota, Bismarck, N. Dak., February 6, 1900:

In the matter of the free distribution of blackleg vaccine by the Department of Agriculture, I wish to say that, having been State veterinarian for six years, I have had considerable experience with vaccine and also had opportunities to observe the immense advantages derived by stockmen and farmers from this experiment by the Department of Agriculture. The protests of commercial vaccine companies should not, in my opinion, prevail over the appeal of the thousands of stockmen that will be forthcoming as soon as this matter is brought to their attention. The work is well within the scope of the Department of Agriculture. The use of vaccine does not alone benefit the individual user, but every stockman for miles around and the public at large. Commercial vaccine has been on the market in this country since 1895, but it did not accomplish much in the way of introducing this preventive until the Government gave it thousands of dollars worth of advertising through its bulletins, and published for free distribution the best work on blackleg and its prevention in the English language. The commercial companies have received great advantages as a result thereof, and I do not think that they alone, at this early date, should receive or have any right to demand exclusive benefit of the great work accomplished by the Department of Agriculture, but rather that the plan adopted by the Department for further experiments be given free scope until such time when the Department sees fit to discontinue the work. Without Government aid in free distribution, vaccination as a preventive would not have reached its present state of almost universal use in twenty years. Only an experiment with introducing it over so great a territory and under so many different conditions and climates will prove as reliable a test as it is possible to make. No great number of people will invest money in a remedy which they consider as experimental, and I sincerely believe that the Department has adopted the only method by which vaccination for blackleg can be introduced and tested throughout the entire stock-raising country. Thus it will accomplish more in a few years than private enterprise could do in ages.

From Andrew Christian, Kirtley, Wyo., February 15, 1900:

I believe that the present method pursued by the Government should be continued, as it will be the means of saving a vast amount of cattle that would otherwise be lost. The Government vaccine is as good as can be made, and I believe that the liberal use of it will reduce blackleg to a minimum and save thousands of dollars worth of cattle in Wyoming alone. We have hundreds of cattle owners in this State who will not buy vaccine until they have lost some cattle at least, while, if they could obtain Government vaccine, they would vaccinate regularly and save their cattle.

From Jesse W. Monk, McFall, Mo., February 22, 1900, to Hon. John Dougherty, M. C.:

In the last twenty years the loss of stock from this one disease has been a very great loss to stockmen of my own personal acquaintance. In my own case, rather than pay the price asked for vaccine, and not knowing but it might be a worthless article, I would run the risk of losses from the disease without vaccinating. I think that would be the sentiment expressed by many stock owners.

From J. R. Phelan, superintendent of the Burlington and Missouri River Railroad in Nebraska, Alliance, Nebr., February 24, 1900, to Senator Thurston:

The Government has distributed free of charge vaccine to hundreds of small ranchers. The result has been extremely gratifying. Many of the poor men owning from 50 to 200 head of cattle, with a mortgage amounting from one-half to two-thirds of what they are worth, could not have bought vaccine from the druggists at the price they charge for it, and would, without vaccine, have lost perhaps half of their calf crop and would to-day have been without either cattle or money. I, therefore, deem it of the greatest importance that the Department of Agriculture be encouraged in this work.

From Walter L. Vail, president of the Land and Cattle Company of Pantano, Ariz., residing at Los Angeles, Cal., February 20, 1900, to Senators Perkins and Bard, and Hon. R. J. Waters, M. C.:

The disease of blackleg among cattle has prevailed to quite a considerable extent in California, but I know it has been largely checked by the use of blackleg vaccine, and I hope it will eventually be entirely eradicated. In my own experience I have found that where, on my ranches in San Diego County, I lost from 5 to 10 per cent of the increase from blackleg before I commenced the use of blackleg vaccine, I have, by its systematic use, been able to reduce this loss to about 1 per cent. The vaccine was that supplied by the Department of Agriculture. It came originally to my notice through operations which brought me in contact with the Bureau of Animal Industry, and I was induced to try it by my confidence in the representations made by the Bureau, which I knew were not promulgated as advertisements, but which were the results of long-continued, careful, and successful researches and experiments. The same representations made by concerns manufacturing this vaccine, however honest, would not have carried the same weight with me as did those of the Bureau, as I could not compare the motives of profit actuating the manufacturers with those of "the good of the cause," which I believe to be the mainspring operating the Bureau. Hence my ever trying the vaccine on my cattle is very doubtful had it not come to us with the prestige of Government representations.

From Walter D. Kemmis, Sidney, Mont., February 8, 1900, to Senators Carter and Clark, and Hon. A. J. Campbell, M. C.:

I wish to say that the disease known as blackleg is dreaded more than any other in eastern Montana, and I firmly believe that the Bureau is pursuing the only effective course favorable to the early eradication of this disease in our great commonwealth. The commercial companies give no information to stock owners, while the Bureau does. Let the Bureau eradicate the disease if it can, and I firmly believe that it has entered upon the only course to stamp it out. Blackleg prevails to the extent of 5 to 25 per cent in eastern Montana among unvaccinated stock. I have never lost a hoof that has been vaccinated. I believe that the Bureau is strictly within its bounds, and I take this opportunity to indorse its work.

From Byers Bros., Kansas City, Mo., to Senators Chilton and Culberson, Hon. J. W. Bailey, M. C., and Hon. John H. Stephens, M. C.:

Speaking from practical experience and observation of the blackleg vaccine sent out by the Bureau of Animal Industry, we think it very greatly to the interests of the cattle raisers that this Department should be encouraged in its experiments. Two years ago we vaccinated about 2,000 head of yearlings on our ranch in Clay County, Tex., with vaccine sent to us by the Bureau of Animal Industry, and as a result we believe our losses were less than 1 per cent. The year previous our loss without vaccination exceeded 5 per cent. We intend to vaccinate about 5,000 head this spring and, in all candor, will say we want vaccine from the Bureau of Animal Industry only.

From W. A. Towers, Prowers, Colo., February 22, 1900, to Senator Teller:

Blackleg is very prevalent in this State and causes great loss to our herds, so much so that I have in several instances known 25 per cent of a calf crop having been lost. Some have had a greater loss, and very few escape without more or less of a loss. I would further say that I have used the commercial product on 1,700 of our calves and sustained a loss of 3 per cent after vaccination. This past year I have used the Government product and my loss has been one-seventh of 1 per cent with 1,400 calves. The cost of this product being infinitesimal in the hands of the Government, and its benefits so general to the many, I think it is the duty of the Department to continue this work; and it may become necessary to make vaccination absolutely compulsory in order to eradicate this disease from the land, the same as has been done in the cases of other contagious diseases which were of great detriment to the country at large. To eradicate blackleg the remedy must be used generally, and, to get this use of it, it must be free to the people.

From Mr. James R. Hebbron, president of the Monterey County Stockraisers' Association, Salinas City, Cal., February 16, 1900:

The Secretary of Agriculture, Hon. James Wilson, through the Bureau of Animal Industry, some two years ago sent me 200 doses of blackleg vaccine, with the request that I report the result of the test for the prevention of blackleg, which had been causing very serious losses to the cattlemen for several years previous. The result was so favorable that several other stockmen of this county who had tried and failed with other remedies, for some of which they had paid high prices, were induced to send for some. Many would, no doubt, not have done so if it had not been furnished free of cost, as agents of commercial vaccine companies had tried to introduce blackleg vaccine without making a single sale that I am aware of. The farmers had no faith in the commercial article, and its cost was an objection without any guaranty of its purity or efficacy, but they were willing to test that which was furnished by the Department, whose motives could not be mistaken; and the consequence is that there has been a great decrease in the mortality from the disease, and I think if the distribution be continued it will arrest if it does not entirely eradicate it.

From J. B. Rhodes, Denver, Colo., February 22, 1900, to Senators Teller and Wolcott:

In my judgment it is of vital importance to all owners of cattle that the Bureau of Animal Industry keep in close touch with this disease (blackleg), and the only way that it can do so is to furnish the vaccine free. It is not a question of cost to the user. It is a question of the minute and careful study given by the experts of the Bureau, not only in the matter of producing vaccine, but in distributing it properly, having it used with discretion, and in following it up and tabulating the results.

COST OF PREPARATION AND DISTRIBUTION OF THE VACCINE.

During a recent discussion on the floor of the United States House of Representatives regarding the propriety of the continued free distribution of blackleg vaccine, the question was brought up as to the cost to the Government of the preparation and distribution of vaccine. It would, therefore, seem pertinent here to enumerate the principal items of expenditure which figure in this branch of the work of the Bureau of Animal Industry, and a statement is given for the fiscal year ended June 30, 1900.

In calculating the actual cost of the vaccine the following items have been taken into consideration:

(1) Salaries. One veterinary inspector, at a salary of $1,400 per annum, is in charge of the attenuation of blackleg virus and superintends the measuring of the vaccine into packets of 10 or 25 doses each. One batch of vaccine comprises, on the average, 18,000 doses, and requires, all told, the inspector's attention for seven hours. While one batch is being prepared another is being tested, a third packed, and perhaps a fourth prepared for shipment. One hundred working days of seven hours each, therefore, produce 1,800,000 doses of tested vaccine ready for shipment. Hence but one-third of the inspector's time is devoted to the subject of blackleg vaccine when the output amounts to 1,800,000 per annum; but as various incidents may interfere with the systematic and regular preparation of the material, it may be estimated that one-half of the salary of the inspector is expended by the Government for his services in connection with the distribution of free vaccine	$700.00
One messenger, at a salary of $660 per annum, assists in sealing the packets, preparing the boxes for shipment, folding circulars, and closing envelopes. At a very liberal estimate half of his time is thus occupied	330.00
One clerk, at a salary of $660 per annum, reads the mail and marks the applications for subsequent action	660.00
One stenographer and typewriter fills in circular letters, addresses envelopes and franks, and acknowledges receipt of applications from members of Congress in behalf of their constituents	600.00
Total	2,290.00

These are the employees actually engaged in the preparation and distribution of the vaccine. Besides these, however, three more clerks or assistants, at salaries aggregating $1,800 per annum, are engaged in summarizing, classifying, and tabulating the numerous reports, attending to card catalogues and files, and preparing maps and tables illustrating the prevalence of the disease in question and the effect of the vaccine as a preventive; but as this work constitutes investigation pure and simple, their salaries can not justly be charged against the free distribution of vaccine, which in itself constitutes a means for the furtherance of our knowledge regarding the nature, cause, and prevention of the disease.

(2) The production of raw material, that is, blackleg meat. Blackleg vaccine is made from the blackleg tumors, or swellings, which appear on the affected animals. In order to obtain this material in pure condition it is necessary to inoculate healthy animals with blackleg virus, and after death to secure the meat from the swellings in such a way as to preclude the possibility of contamination with germs (especially malignant edema), which might have a deleterious effect on the vaccine. During the fiscal year ended June 30, 1900, twenty yearling cattle were purchased for this purpose, at the aggregate cost of	$452.50
Other expenses incidental to the drying and shipping of the meat amount to	41.00
(3) Vaccine envelopes, contract price, $1.375 per thousand. For the distribution of 1,076,000 doses of vaccine there were used 35,870 ten-dose envelopes and 28,692 twenty-five dose envelopes; total, 64,562 envelopes	88.87
(4) Wooden boxes for shipment of the vaccine; contract price, $12 per thousand; total number used, 6,142	73.70
(5) Stationery and circular letters, including envelopes, franks, and application blanks	71.69
(6) Printed directions for the preparation and use of the vaccine, 6,142 copies, at $28.50 per 5,000	35.00
(7) To the above-enumerated expenses must finally be added postage. Of course, all vaccine and correspondence pertaining thereto are mailed under the Government frank, but in calculating the actual expense to the Government in making and distributing the vaccine the postage must be included. We therefore add 2 cents postage on 18,426 pieces of mail	368.52
Total	1,131.28
Add to this sum the total amount expended for salaries	2,290.00
Making a grand total of	3,421.28

With the expenditure of this sum there were prepared and distributed during the fiscal year ended June 30, 1900, more than 1,076,000 doses of blackleg vaccine. Consequently each dose of vaccine cost the Government less than one-third of 1 cent (0.318 cent per dose), or at the rate of $318 for each 100,000 doses. The commercial price of the same amount exceeds $10,000. When it is further considered that the application of 100,000 doses of fresh, reliable vaccine means the saving of $250,000 worth of cattle at $20 per head by reducing the mortality from approximately 12 per cent to one-half of 1 per cent, it must be admitted that each $318 expended by the Government for this purpose is well spent.

Below will be found copies of two letters which contain matter of interest in regard to the blackleg question. The first is from the noted buffalo breeder, Mr. Charles Goodnight, of Goodnight, Tex., whose views regarding the immunity of the buffalo and its crosses are of value, as probably no other man in this country has had the same experience with wild and captive buffaloes as has Mr. Goodnight. The other, from Mr. J. C. Miller, of the 101 Live Stock Company, of Bliss, Okla., is notable as illustrating the insusceptibility of man (or at least Indians) to blackleg.

Mr. Goodnight writes as follows:

> I have been satisfied for the last ten years that buffaloes are not susceptible to blackleg, but have not felt disposed to give it to the world as a whole, as it may yet develop. I was among the wild buffalo for several years where they were immensely numerous, and many thousands were of the proper age to take it. I have now been breeding them about twenty years and am quite positive no case of blackleg occurred during that time, and up to this writing it holds good to those that are only one-fourth blood. I will this year have several head of calves only one-eighth blood, and I shall give them every chance to take blackleg in order to test them, although I think they are immune. I have been trying for several years to establish a race of cattle from the buffalo. So far I have only partially succeeded. When this is done it will be the greatest thing for the cattle industry of America. They have some characteristics that are very valuable to this interest. Besides their great weight and the extra quality of the meat, they are: First, most probably immune from blackleg; second, they never eat loco; third, they never lie with their back downhill, which causes much loss in weak cattle; fourth, they do not go in bog holes; fifth, they have the greatest lungs of any animal on earth; sixth, they put on more flesh for what they eat than other animals.

The following is the letter from Mr. Miller:

> We are ranching on an Indian reservation and the Indians would about as soon eat dead cattle as to eat any other kind. When these cattle would die the Indians would come and skin them and eat the meat. They have eaten about forty head of them, and I guess there is no danger in it. I have also seen them eat cattle that had died of Texas fever, and hogs of cholera and other diseases, and have never known one to be sick on that account. The Indian agent does what he can to prevent them from eating food of this kind, and I used to try to keep them from doing it, but could not, and as it does not seem to hurt them any I don't pay any more attention to it.

NOTE.—The four illustrations of a vaccinating, branding, and dehorning chute have been submitted by Messrs. Painter Brothers, of Roggen, Weld County, Colo., who were the originators and builders of this chute.

PATHOLOGICAL CONDITIONS FOUND IN MEAT INSPECTION.[1]

By D. E. SALMON, D. V. M.,
Chief of Bureau of Animal Industry.

The more common and important pathological conditions found in meat inspection are no doubt subjects of considerable interest to the members of this association. These conditions may affect the public health to a certain extent, and they are unquestionably worthy of careful study by the sanitarian as well as the pathologist.

The Federal meat-inspection service, having been in operation about nine years, has now reached a stage of development and an approach to uniformity of procedure which justifies the expectation that some thought may hereafter be given to the utilization, for scientific purposes, of some of the material which it furnishes. While we have not in the past entirely neglected the collection and study of the pathological material, the imperative necessity of organization and of the investigation and control of the more destructive animal plagues has prevented us from using this material to any great extent, either for illustrative purposes or for scientific study.

The specimens which are exhibited here[2] are nearly all in a fresh condition and have been preserved by freezing. They are only such as could be collected in a comparatively short time, but they are of special value as showing the natural appearance of the affected meat. To give some idea of the frequency or infrequency of disease in our meat-producing animals, I have taken from our reports some statistics covering the two fiscal years beginning July 1, 1897, and ended June 30, 1899. These statistics are especially valuable on account of the large number of carcasses inspected during that period, and refer entirely to the postmortem examination.

During the two years mentioned the number of cattle examined reached a total of 8,831,927. Of these cattle 19,454 entire carcasses and parts of 23,106 additional carcasses were condemned. This means that 22 carcasses in 10,000 were entirely condemned and that 26 carcasses in 10,000 were partly condemned, making a total of 48 carcasses in 10,000 condemned in whole or in part. Of the 23,106 carcasses, parts of which were condemned, 12,641 were affected by bruises or injuries, 7,120 by abscesses, 3,025 by localized actinomycosis, 268 by localized tuberculosis, 11 by tumors, 6 by hydatids, and the remainder by circumscribed inflammation of various organs. Of the 19,454 carcasses which were wholly condemned, 7,015 were affected by tuberculosis, 5,172 by actinomycosis, 2,530 by anemia, emaciation, etc., 2,227 by bruises and injuries, 598 by septicemia, 384 by pneumonia, 268 by peritonitis, 222 by pyemia, 212 by icterus, 205 by abscesses, 166 by Texas fever, 95 by advanced pregnancy, 90 by enteritis, 44 by cancer, 42 by gangrene, 24 by metritis, 15 by recent parturition, 1 by anthrax, and the remainder (144) mostly by tumors and inflammation of the various organs.

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[1] Read at the meeting of American Medical Association, held at Atlantic City, N. J., June 5-8, 1900.

[2] No illustrations were made of the specimens that were exhibited.

The number of sheep inspected during this period reached 11,110,776. Of these sheep 8,394 carcasses, or 7½ per 10,000, were wholly condemned, and 650 carcasses, or 0.6 per 10,000, were condemned in part. Taking the carcasses of which only parts were condemned, 379, or more than one-half, were affected by bruises and injuries, 132 by abscesses, 91 by hydatids, 41 by the *Œsophagostoma columbianum*—the parasite causing the nodular disease of the intestines, 4 by scabies, and 3 by tuberculosis. Of the 8,394 entire carcasses of mutton condemned, 2,345 were affected by anemia and emaciation, 1,696 by bruises and injuries, 667 by tuberculosis and pseudotuberculosis, 550 by abscesses, 464 by pneumonia, 422 by uremia, 371 by septicemia, 370 by icterus, 256 by pyemia, 204 by pleurisy, 171 by ascites, 154 by scabies, 131 by advanced pregnancy, 118 by hydatids (Echinococcus), and the remainder (375) mostly by inflammation of various organs, fever, recent parturition, parasites, tumors, and cancer.

The number of hogs slaughtered under inspection during the same period was 44,841,779. Of these hogs, 106,555 carcasses were wholly condemned, being about 24 per 10,000, and 58,491, or 13 per 10,000, were condemned in part. Of the carcasses only partially condemned, 37,167 were affected by bruises or injuries, 7,853 by tumors, 7,338 by abscesses, 1,971 by hydatids, 1,683 by tuberculosis, 1,313 by mammitis, 1,119 by pleurisy, and 47 by actinomycosis. Of the carcasses wholly condemned, 85,904 were affected by hog cholera and swine plague, 4,021 by tuberculosis, 2,298 by icterus, 2,065 by pyemia, 1,847 by abscesses, 1,709 by pneumonia, 1,570 by advanced pregnancy, 1,463 by septicemia, 1,294 by bruises and injuries, 1,099 by tumors, 1,500 by inflammation of organs in the abdominal cavity, 536 by anemia and emaciation, 321 by recent parturition, 267 by fever, 113 by scabies, 43 by actinomycosis, 60 by *Cysticercus cellulosæ*, or measles of swine, 23 by hydatids, and 9 by cancer. The remaining 313 were for the most part affected by skin diseases, gangrene, and inflammation of various organs. There have not been included in this statement the condemnations for trichinæ infestation, since pork for the domestic markets is not examined microscopically.

The proportion of condemnations for the different varieties of animals is shown by the following table:

Table showing the number of whole carcasses and parts of carcasses condemned per 10,000 animals slaughtered.

	Cattle.	Sheep.	Swine.
Whole carcasses	22	7.5	24
Parts of carcasses	26	0.6	13
Total	48	8.1	37

In general terms it may be said that the proportion of condemnations with cattle and swine correspond quite closely, while with sheep it drops to one-fifth of the figures for swine and one-sixth of those for cattle. The relatively large number of condemnations with cattle is somewhat surprising, since they are generally considered the most hardy and healthy of our domesticated animals. An examination of the causes of condemnation shows, however, that more than half of the parts of carcasses rejected were affected by injuries received in shipment, while almost one-third were condemned for abscesses, many of which no doubt were also due to mechanical injuries; that is, cattle on account of their size, weight, and combative disposition are particularly liable to injuries which may require the removal of a part of the carcass. Making allowance for such injuries, the condemnations with cattle will be no greater than with swine. The small proportion of condemnations with sheep is remarkable, particularly when we consider their delicacy of constitution and their feeble powers of resistance to unfavorable conditions.

When we examine into the causes of condemnations with cattle we are impressed by the relative number due to actinomycosis and tuberculosis. Of the whole carcasses condemned, 26 per cent were affected with actinomycosis and 36 per cent with tuberculosis. Of the parts of carcasses condemned, 13 per cent were affected with actinomycosis and 1 per cent with tuberculosis. Nevertheless, there is a surprisingly small proportion of the beef-producing cattle, as they come to our large abattoirs, which are affected with these diseases. Taking the total condemnations of whole carcasses and parts of carcasses for tuberculosis, we find but 8.1 per 10,000 animals; and in the same manner with actinomycosis, we find 9.2 per 10,000 animals. Actinomycosis also affects hogs and sheep, but much more rarely than cattle. Thus with hogs, 43 whole carcasses and 47 parts of carcasses were condemned for this disease out of 44,841,779 carcasses inspected. That is something over two affected carcasses to a million. This does not give an accurate idea of the frequency of actinomycosis with hogs, however, as many of the tumors for which condemnations were made were undoubtedly of actinomycotic growth. In sheep two whole carcasses were condemned for actinomycosis out of 11,110,776. Tuberculosis is one of the principal diseases found in swine, though it is far less common than with cattle. Adding together the number of whole carcasses and parts of carcasses condemned, we find that approximately 1.3 hogs per 10,000 are affected. Tuberculosis in sheep is a very rare disease. Our reports give tuberculosis and pseudotuberculosis together, the latter being much the more common. Including both, however, there are specified but 6 condemned in 100,000 sheep inspected. It is quite probable that some of the abscesses reported were due to pseudotuberculosis.

Tuberculosis in cattle is generally a localized disease. It affects most frequently the bronchial and mediastinal lymph glands and lungs, but very often the abdominal lymph glands, the liver, or the spleen is invaded. Sometimes it is generalized and tubercles are found widely distributed, affecting even the muscles and bones. Some statistics show the uterus involved in about 10 per cent of the tuberculous cows and the udder in 1 or 2 per cent.

Our inspectors are instructed to condemn (1) all carcasses affected with generalized tuberculosis, (2) all carcasses with extensive localized tuberculosis, and (3) all carcasses with localized tuberculosis that show signs of emaciation. This ruling is considerably more stringent than the European practice, which allows carcasses affected with localized tuberculosis to go upon the market without regard to the extent of the lesions, except in case of marked emaciation. Even generalized tuberculosis is not always considered in other countries a sufficient cause for condemnation, and those carcasses in which the lesions are apparently confined to the organs of the body cavities, especially if the process of generalization has not been recent, are passed as fit for food.

The beef cattle which come to our large abattoirs are singularly free from tuberculosis, since only one animal in 1,500 or 2,000 is affected to an extent which causes the condemnation of any part of the carcass. Dairy cattle, however, are much more seriously affected and from 5 to 10 per cent may be found tuberculous. In European countries the tuberculosis of cattle is much more frequent than in the United States, the slaughterhouse statistics showing from 20 to 50 per cent of all such animals to be affected.

There is a possibility of fetal infection in bovine tuberculosis, but such cases are quite rare. The congenital form of tuberculosis exists in probably less than 1 per cent of the calves born of tuberculous mothers. The tuberculosis of calves arises from virulent milk used as food rather than from infection in utero. The specimens of tuberculous udders illustrate the appearance of the affected gland, and also the possibility of large quantities of virulent material finding its own way into the milk. The milk should be considered dangerous in all cases in which the disease has invaded the udder, and it may also be infectious in advanced cases of tuberculosis, although no lesions can be discovered in the udder.

There is not time on this occasion to discuss the transmission of bovine tuberculosis to man. I believe that such transmission occurs and that precautions should be taken to guard against it. The frequency with which tuberculosis is communicated from animals to man can only be determined by the long-continued, careful, and concerted observation of physicians. The data which we now have is meager and much of it is unsatisfactory. It consists (1) of accidental inoculation and (2) of primary tuberculosis of the intestines or mesenteric glands. In the former case the origin of the lesion is generally very clear; in the latter we can only infer that the bacilli were introduced with the food. When the death of a number of persons in the same institution (school or asylum) occurs from abdominal tuberculosis and the cows furnishing the milk are found to have their udders affected with the disease and to be producing virulent milk, the evidence of transmission is about as strong as we can expect to obtain. Unfortunately sufficient attention has not been given to such observation in this or in other countries, so far as I am aware. Careful postmortem examinations of children that die in asylums and hospitals should in time furuish most valuable evidence.

As an example of what is in mind you are referred to a communication by George F. Still, M. A., M. D., M. R. C. P., in the British Medical Journal, August 19, 1899, page 455. This communication gives the results of 769 consecutive autopsies on children, all being hospital patients. Of these, 269 presented lesions of tuberculosis. So far as could be ascertained, 53 were infected by way of the intestine, and 10 others were probably infected through this channel; that is, 63 out of 269, or 23.4 per cent, probably contracted the disease by infection taken with the food. There were 43 cases in which death occurred from some other cause than tuberculosis; and these cases were noted as furnishing almost indisputable evidence of the method of infection in each individual case, since the tuberculous disease had either been arrested in its early stages or had not yet progressed beyond the initial stage. With these cases the evidence as to primary focus of infection was as follows: Lung 26, intestine 16, ear 1. That is, where the evidence was most clear the infection was by the digestive tract in 37.2 per cent of the cases. It is a pity that we have not enough evidence of this character from the principal countries to enable us to form an intelligent opinion as to the relation, if any, which exists between the frequency of tuberculosis in the food-producing animals and that of abdominal tuberculosis in mankind.

Although tuberculosis is less common in swine than in cattle, it has a greater tendency to generalization, and affected carcasses need to be very carefully scrutinized before they are passed as fit for food. The specimens showing the tuberculous lesions in cattle and hogs will be found most interesting, particularly those from the udder of the cow and those illustrating the generalized form of the disease in swine.

The pseudotuberculosis of sheep is a very interesting disease, generally found among animals which have originated in the southwestern section of the United States, from Texas to California, inclusive. It is generally observed in mature animals, though it is occasionally found in lambs. The lymphatic glands, lungs, and liver are the parts oftenest affected. One or more of the prescapular, inguinal, sublumbar, mediastinal, or bronchial glands may be found enlarged, and upon pressure gives a sensation such as would be expected from a thick-walled sac containing semifluid material. On section, the contents are found to be yellowish green and caseous, while the capsule is grayish white, fibrous, and firm. Sometimes the caseous substance closely resembles the contents of softened tubercles, but in older lesions it has a greater consistency, finally becoming dry and mealy. As a rule, these lesions do not present evidence of calcification. The lesions in the lungs, liver, and other organs have a similar appearance. They are always well defined and surrounded by a wall of fibrous tissue.

Microscopic examination of cover-glass preparations made from the caseous material and stained by Gram's method demonstrates the presence of a small ovoid bacillus. It develops on agar in the course of forty-eight hours as an irregular whitish colony with crenated border and papillated center. In bouillon turbidity occurs in thirty-six hours, and in forty-eight hours a heavy, white, granular precipitate forms at the bottom of the tube.

Intravenous inoculations of rabbits and guinea pigs cause death in six to ten days, with cheesy foci of varying size in the lungs, liver, kidneys, and spleen. Subcutaneous inoculations cause death in these animals in twenty-five to thirty days, with caseous degeneration of the tissues near the point of inoculation and lesions of the neighboring lymphatics. Feeding experiments with these small animals produce fatal results in eight to ten weeks, the lesions being identical with those caused by intravenous inoculation, except that the lymphatic glands of the head and throat are more frequently involved. Feeding experiments with sheep have given negative results. Intravenous inoculation of sheep with material from the caseous lymphatic glands of diseased animals have produced in the lungs in the course of eight weeks only small caseous foci the size of a hazelnut.

Another interesting disease is the nodular disease of the sheep's intestine. These nodules, which have often been regarded as of tubercular nature, are really due to the irritation caused by the immature form of an intestinal worm, the *Œsophagostoma columbianum*. This is a very common disease and apparently affects only the sheep's health when the nodules are so numerous as to interfere with the assimilation of the food. In some parts of the country the Œsophagostoma is a great pest and multiplies so rapidly that it is practically impossible to keep sheep successfully in large flocks.

The frequency with which hogs are found affected with cholera and swine plague is indicated by the fact that, of 106,555 carcasses condemned, 85,904, or 80.7 per cent, were rejected for this cause. It is therefore important that inspectors should be familiar with the appearance of meat affected by this disease.

Your attention is invited to the specimens illustrating the lesions of actinomycosis in the jaw, tongue, liver, lungs, and udder. The actinomycotic process is most frequently seen in this country affecting the maxillary bones, where it causes a large, hard, suppurating tumor, which disfigures the animal and gives it a very unprepossessing appearance. The tongue is often affected, becoming enlarged, hard, and filled with nodules containing caseous material.

Actinomycotic tumors may be found in the pharynx, larynx, and esophagus. Lesions resembling those of tuberculosis are found in the lungs, liver, and peritoneum. In general, it may be said that the actinomycotic lesion develops either with a tubercular appearance or as a soft, moist, reddish tumor, or, finally, as a hard, fibrous tumor. There is a tendency to disintegration and suppuration, and sometimes the lesion consists simply of an abscess. The presence of the actinomyces tufts constitutes a reliable means of diagnosis.

The repulsive appearance of animals affected with actinomycosis of the head has inclined some sanitarians to give undue attention to this disease to the neglect of others having a greater effect upon the flesh and that are more dangerous to the consumer. As this disease is probably not transmitted from animals to man, the carcasses are only condemned when there is emaciation or when the lesions are so large, active, or disseminated as to affect the system at large.

Perhaps I should explain that while in some countries—possibly in most countries—the meat inspectors condemn only such meat as they believe to be clearly injurious to consumers, we go somewhat further in this country and condemn much meat which is not actually injurious, but which for various reasons is repugnant. In this class may be placed the carcasses of animals advanced in pregnancy, or those which have recently given birth to their young; the unborn fetus and the very young calf or lamb; the carcasses of animals suffering from pneumonia, pleurisy, or some other noninfectious diseases; the greater part of the actinomycotic carcasses and of those affected with extensive though localized tuberculosis. On the same principle we destroyed the carcasses of all cattle affected with contagious pleuropneumonia when we were engaged in the work of eradicating that disease, although it had been proved by European experience that the flesh of these animals might be consumed with impunity.

Turning now to the animal parasites which are encountered on the slaughtering floor, it may be observed that the subject of meat inspection for these organisms bears both a direct and an indirect relation to public health; for we find parasites, some of which are transmissible directly to man through the meat eaten as food, while others are transmissible indirectly, first passing a stage of their life in some other host. Among those which are transmissible directly to man, your attention is especially invited to the larval stages of tapeworms. *Cysticercus bovis* occurs in cattle, and when eaten by man gives rise to the common tapeworm found in this country, *Tænia saginata* by name. The specimen exhibited is a cross section through the tongue of a calf, and these bladder-like structures, more or less resembling particles of fat, represent the larval worm. The adult tapeworm from man is shown in the second bottle. This particular tapeworm is not an especially dangerous parasite. It may bring about digestive troubles, and it is occasionally very difficult to expel it; but, as a rule, we may say that the parasite is only of temporary importance, its effects passing off when the worm is expelled. With this next specimen the matter is entirely different. This is the so-called pork "measle tapeworm," *Tænia solium*, and is contracted by swallowing the larval bladder worm, *Cysticercus cellulosæ* by name, which occurs in pork. Owing to the fact that Americans are in the habit of cooking or curing pork quite thoroughly before consuming it, the larval stage is usually killed; hence the adult parasite, *Tænia solium*, in man is rather infrequent in this country. It will, however, be found among Germans and others who are in the habit of eating raw or rare pork. Sometimes, perhaps, physicians do not attempt to distinguish between cases of infection among their patients by the two worms just mentioned. The fact should not be lost sight of, however, that the *Tænia solium* is a very much more dangerous parasite than *Tænia saginata;* for if a patient soils his hands with the microscopic eggs during defecation, or if he has reverse peristalsis of the intestines strong enough to carry one or more segments of the tapeworm into the stomach, he infects himself with the larval stage. In this case the embryos escape from the segments into the stomach and wander to various parts of the body, more especially to the muscles, the eyes, and the brain. If one of the larvæ develops in the eye, more or less serious conditions may result; while if they develop in the brain they may lead to serious complications, according to the part of the brain in which they grow, and may finally result in death. Again, it may not be amiss to remind physicians that in treating for tapeworms they constantly stand in danger of infecting themselves with the larval stage if they handle the *Tænia solium*, a danger which does not exist in connection with *Tænia saginata.* The existence of these two parasites in our American cattle and hogs leads me to suggest that the practicing physician has a duty to perform in seeing that all tapeworms passed by his patients are totally destroyed, unless preserved for scientific work. It too often happens that the patient is not properly instructed in this matter and passes the worm in some place where the eggs are scattered, so that they afterwards infect cattle and hogs.

The meat inspection in Germany has resulted in decreasing the frequency of tapeworm disease in man, as well as the infection with the larval stage of *Cysticercus cellulosæ.* We have no exact statistics on this subject for the United States, but it would appear that the Federal meat-inspection system must necessarily contribute its share to the decrease of tapeworm disease. If physicians will do their part in burning the tapeworms passed by their patients, there is no reason why we should not gradually eradicate these two parasites from the country.

Another parasite transmissible directly to man through means of the meat is the noted *Trichina spiralis*, the cause of the disease trichinosis. Fortunately, our curing and culinary methods are a great protection against infection with this worm. We do not make an inspection with a view of excluding this parasite from the pork which is consumed in this country. It would cost us nearly $3,000,000 per annum to accomplish this, and the statistics of Germany show beyond a question that a microscopic examination is not of such great value as is generally supposed. The Bureau of Animal Industry has recently compiled over 14,000 cases of trichinosis in Germany, from 1860 to 1898, inclusive, and from our compilation it appears that the general mortality of the disease is 5.6 per cent. Of over 6,000 cases which occurred during the years 1881 to 1898, inclusive, about 51 per cent of all the cases were due to faults in the microscopic inspection, the vast majority of these occurring from meat which had been inspected and passed as free from trichina. One is scarcely warranted in recommending that this Government expend $3,000,000 per annum for the general introduction of a sanitary inspection which the German statistics prove to be so uncertain, an inspection which is calculated to raise a false sense of security among our people and which might tend to increase the dangerous custom of eating raw or rare pork. Trichinosis may be prevented much more effectually by educating the public to the use of thoroughly cured pork, and to the idea that when it is not thoroughly cured it should, at least, be thoroughly cooked.

Finally, I invite your special attention to an animal parasite which is apparently on the increase in this country. I refer to the echinococcus, the cause of the hydatid disease. This bladder worm may be found in almost any part of the body of the meat-producing animals, and especially in the lungs and liver of cattle, sheep, and swine. You will pardon me, I trust, for recalling some points in its life history which are no doubt familiar to you. If a man were to eat an affected organ it would do him no harm, for the parasite is not directly transmissible from these animals to man. If, however, the hydatid worm is fed to a dog each separate head of the cyst—and there may be thousands in a single cyst—develops into a small tapeworm, which I shall be glad to exhibit to those who are interested in this subject. It is probably the smallest tapeworm known, having very few segments, and only the last segment is gravid with eggs. The dog scatters the eggs of this tapeworm broadcast and the domesticated animals become infested with it. Mankind may also become infested with this parasite by a too close intimacy with dogs. In Iceland, where men and dogs live during the long months of winter in the same huts and without any idea of sanitary precautions, it is said that 1 person out of 43 is affected by the echinococcus disease. In some parts of Germany the disease is also very frequent. Ostertag gives a table from which it appears that at Rostock, out of 1,026 postmortems on man, 25 cases were found, or 2.43 per cent; at Breslau, out of 1,360 postmortems, there were 20 cases, or 1.47 per cent; at Berlin, out of 4,770 postmortems, there were 33 cases, or 0.76 per cent. It is also alleged to be common in Siberia, India, and Australia. The disease can be controlled only by careful meat inspection and the destruction of all the hydatids that are found. Unfortunately, the local slaughterhouses of this country are not looked after so closely as they should be. It is often an easy matter for dogs to gain access to such premises and to become infected with this parasite and thus propagate the infection. To prevent this and other diseases there should be expert supervision over all slaughterhouses. Places for slaughterhouses should be reduced in number, so that all the butchers of a town or village would slaughter at the same place; and the premises where slaughtering is done should be under the surveillance of the local board of health. Offal feeding should be done away with, in order to prevent the propagation of this class of parasites, and under no circumstances should a dog ever be allowed upon the premises.

I trust this brief and somewhat superficial review of the subject of meat inspection, and the exhibition of specimens, may serve to increase the interest of physicians in this branch of sanitary work. It is only through the examination of the pathological specimens actually found by the meat inspectors that we are able to appreciate the importance of having experienced and educated men on guard to withdraw carcasses so affected from the meat supply of the country. The great mass of our citizens have no conception either of the disease found among animals at the abattoirs or of the enormous amount of work which our Government is doing to protect them from diseased animal products. No public work, however, can long be sustained or carried to the highest degree of efficiency unless the people of the country understand its objects and value and become interested in it. This being true as a general proposition, we can hardly expect the meat-inspection service, interfering, as it must more or less, with some of the wealthiest and most powerful industrial organizations in the world, to be conducted with vigor and a rigid adherence to correct principles unless there is a popular appreciation of the value of the work to every consumer of meats. This service must appeal first of all to the physician, who, being familiar with pathological appearances, can, by inspecting these specimens, judge of their seriousness and their influence upon the public health.

INTERNATIONAL LIVE STOCK EXPOSITION OF 1900.[1]

During the past year there was an unusual amount of interest manifested at exhibitions throughout the country among feeders and raisers of the improved breeds of live stock and their crosses. This interest culminated in bringing together at Chicago on December 1 to 8, 1900, the largest aggregation of live stock for show purposes ever seen in this country. It was held under the auspices of the International Live-Stock Exposition, an organization composed of the National Association of Exhibitors of Live Stock and the Union Stock Yard and Transit Company of Chicago. This exposition comprised representatives of each of the different breeds of purebred domestic animals, besides grades and crosses, aggregating a grand total of 6,077 head. On these over $50,000 was paid in premiums to the owners.

The breeds were classified as follows: 2,689 head of cattle, consisting of 409 Herefords, 312 Shorthorns, 228 Aberdeen Angus, 211 Galloways, 165 Red Polls, 144 Polled Durhams, 25 Devon and Sussex, and 1,195 fat animals. There were 434 head of horses, consisting of 74 Clydesdales, 71 Percherons, 23 Shires, 15 Belgians, 7 French Draft, 2 Suffolk, and 233 of other classes. There were 1,832 head of sheep, consisting of 226 Shropshires, 70 Southdowns, 82 Oxfords, 157 Hampshires, 58 Dorsets, 66 Cheviots, 112 Cotswolds, 237 Lincolns, 75 Leicesters, 245 Rambouillets, and 500 fat sheep. There were 985 head of swine, consisting of 163 Poland Chinas, 174 Berkshires, 110 Chester Whites, 171 Duroc Jerseys, 56 Tamworths, and 357 head of other classes. These animals came from the different parts of the United States and Canada, but principally from those States of the Mississippi Valley known as the corn belt, showing that where the cheapest feeds are grown there the bulk of our fat stock is produced.

The object of the exposition was to bring together those interested in these great industries, and to show by object lessons the conditions and the kind of animals demanded by the market. To this end, every effort was put forth by the management to accomplish the desired result. College professors and veteran breeders were secured as judges; students from the agricultural colleges were induced to practice card-scoring as it is taught in their institutions; auctions of pedigreed animals were held daily, each exhibitor being allowed to contribute three animals to the sales; the Bureau of Animal Industry demonstrated the microscopic test as it is used for the detection of trichinæ in pork products that are to be shipped to foreign countries; packing establishments invited inspection of their plants, where the living animal is quickly transformed into manufactured articles of commerce; and many other opportunities were afforded which rendered the educational features of the exposition of great value.

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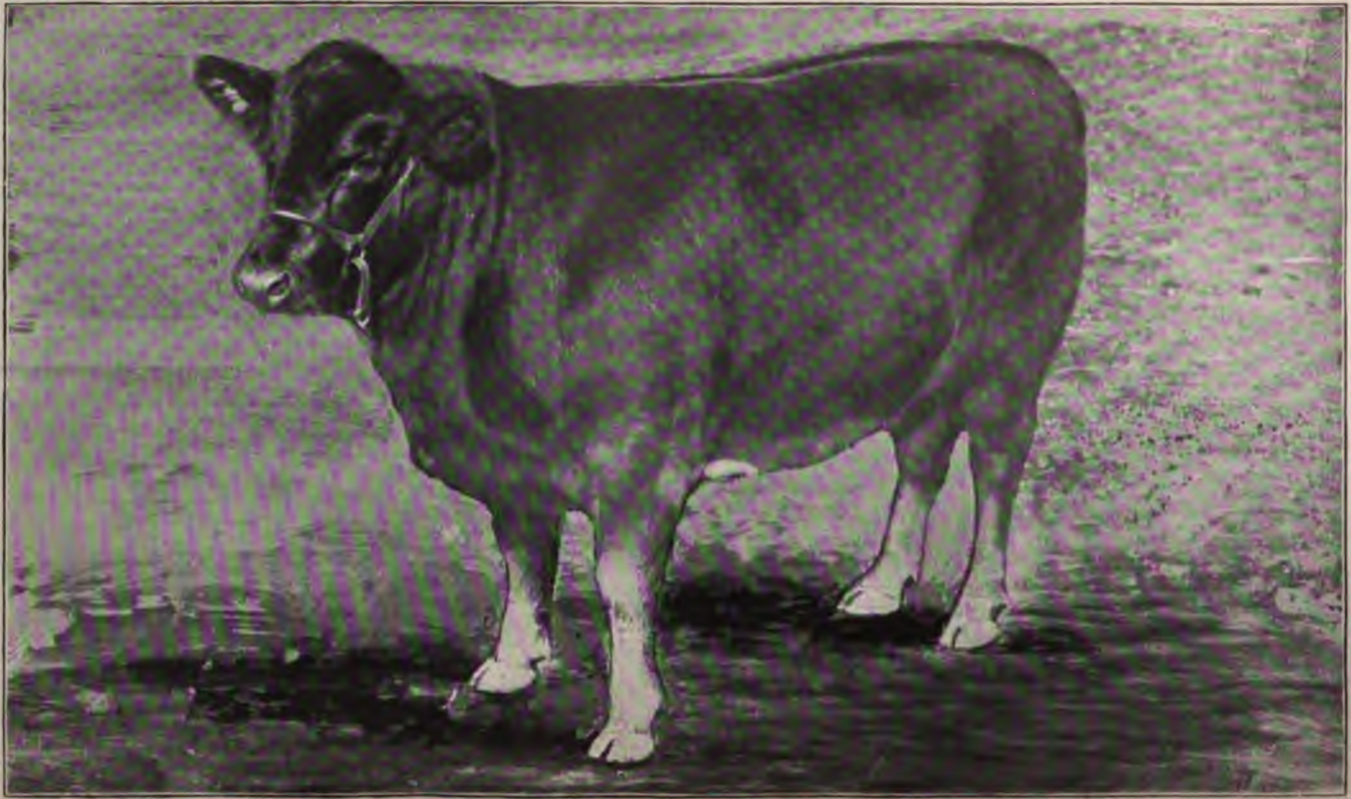
[1] From notes by James W. Wilson and George G. Hill.

Three hundred and fifty-five head of purebred animals were sold at public sale, the prices amounting to $119,550, an average of $336 per head, in addition to numerous private sales, of which we have no record. A Hereford bull calf was sold for $3,500, this being the highest price given for an animal during the exposition. The prices paid for the carload lots entered in the exposition ranged from $6.50 to $15.50 per hundred pounds on the hoof, being purchased for the Christmas trade, while the market quotation at the same time was from $6 to $6.25 per hundred pounds.

The following table shows the prices obtained for various lots of cattle sold:

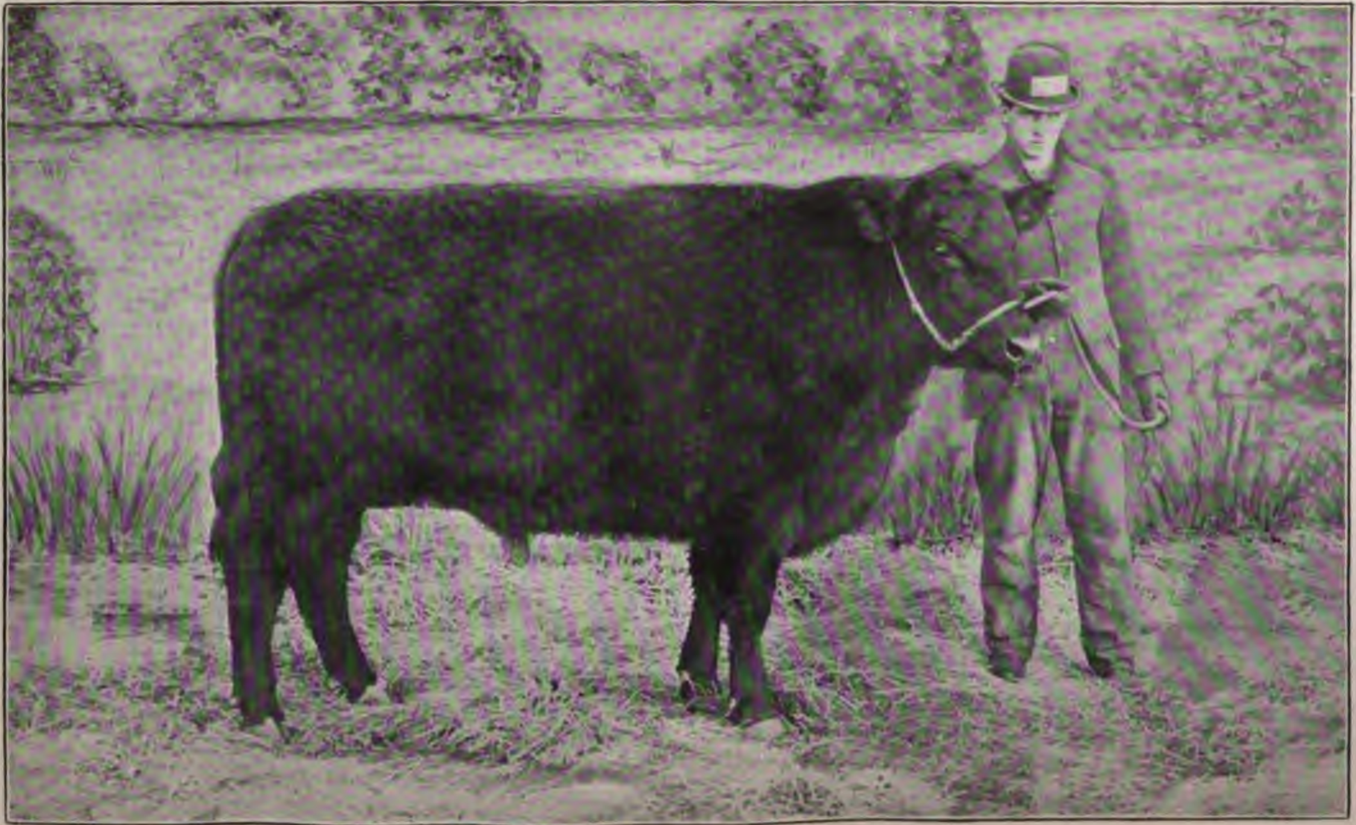
Number, breed, average weight, and price per hundredweight of beef cattle sold.

Breed.	Number sold.	Average weight (pounds).	Price per cwt.
Aberdeen Angus	1	1,430	$150.00
Do	15	1,492	15.50
Do	1	1,800	13.00
Do	15	1,498	11.00
Herefords	15	1,431	9.80
Shorthorn yearlings	15	1,216	8.50
Aberdeen Angus	1	1,460	8.25
Herefords	15	1,236	8.00
Aberdeen Angus	15	1,540	7.50
Herefords	15	1,648	7.50
Do	1	1,570	7.50
Aberdeen Angus	15	1,164	7.30
Shorthorns	1	1,600	7.30
Do	1	1,550	7.30
Do	1	1,690	7.30
Aberdeen Angus	17	1,540	7.25
Shorthorns	8	1,242	7.10
Aberdeen Angus	15	1,502	7.05
Shorthorns	5	1,622	7.00
Shorthorn yearlings	15	1,140	7.00
Galloway calves	43	408	7.00
Aberdeen Angus	15	1,544	6.90
Herefords	17	1,371	6.80
Shorthorns	15	1,663	6.80
Do	1	1,810	6.75
Do	1	1,900	6.75
Aberdeen Angus	15	1,195	6.65
Do	15	1,614	6.65
Do	15	1,620	6.65
Do	15	1,561	6.65
Herefords	15	1,620	6.65
Aberdeen Angus	1	2,040	6.60



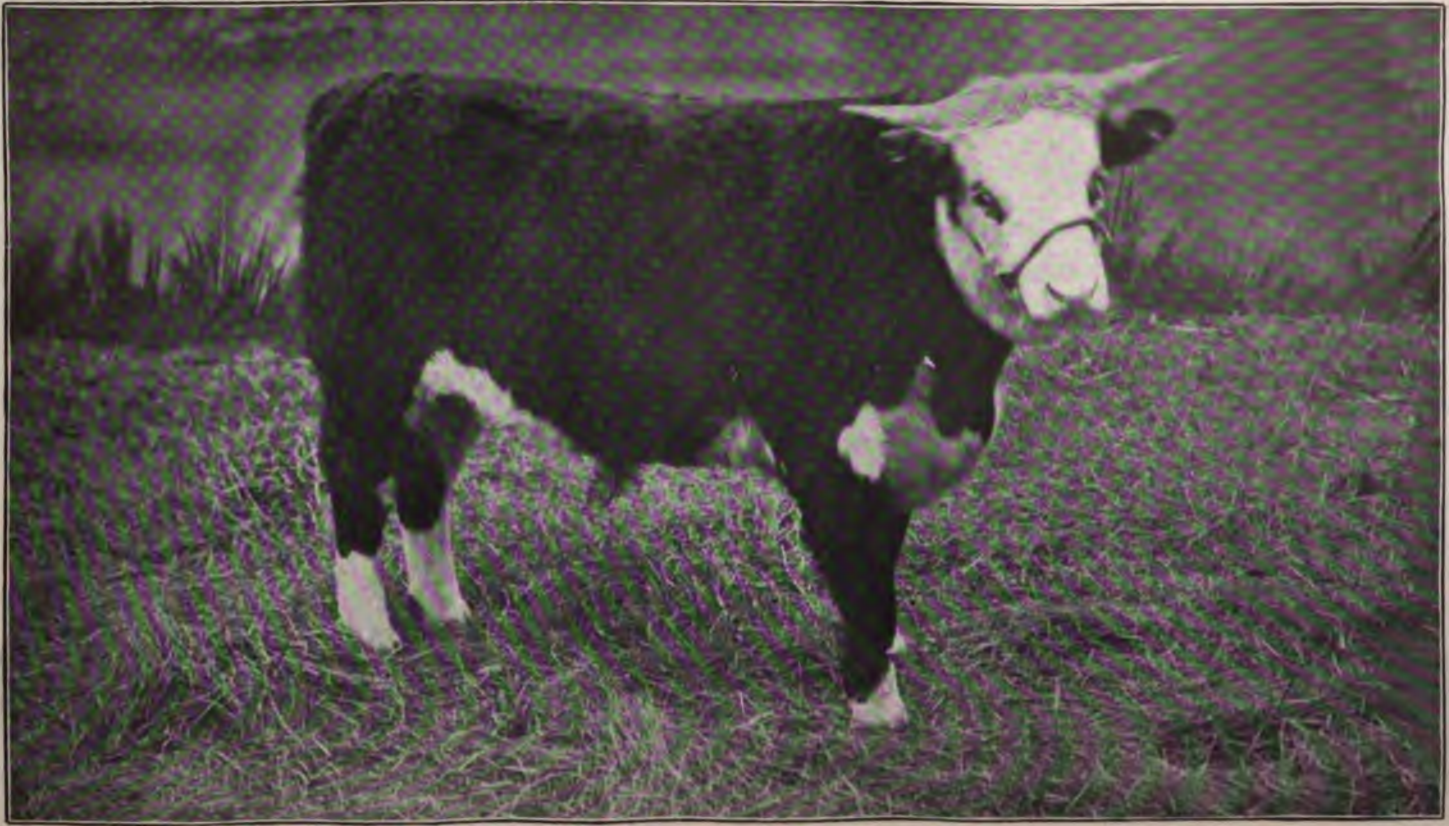
INTERNATIONAL LIVE STOCK EXPOSITION.—ADVANCE, GRAND CHAMPION ABERDEEN ANGUS STEER, ALL AGES AND BREEDS COMPETING; ALSO WINNER OF YEARLING CHAMPIONSHIP, ALL BREEDS COMPETING.

(Bred and fed by Stanley R. Pierce, Creston, Ill.)



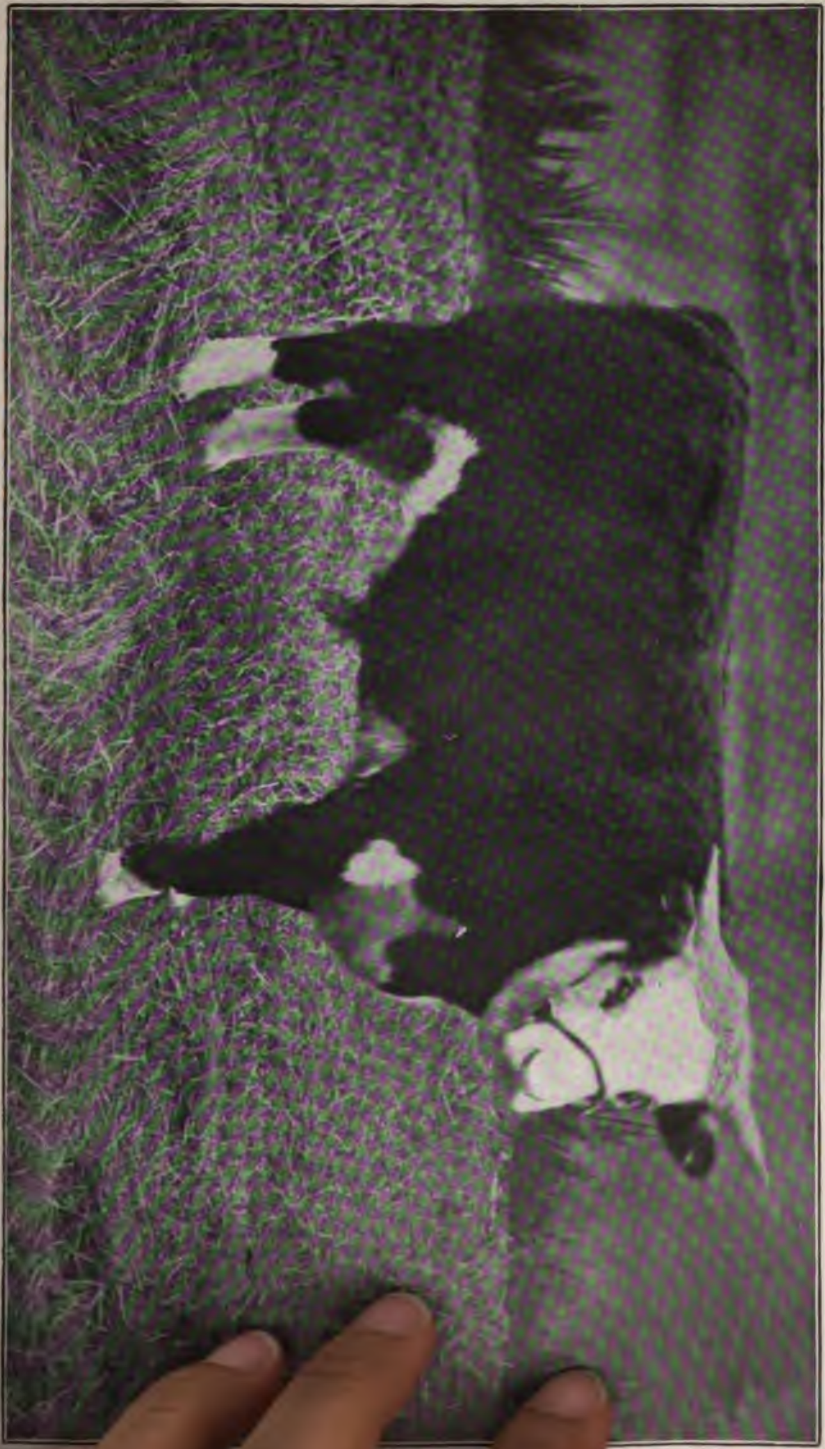
INTERNATIONAL LIVE STOCK EXPOSITION.—GOOD TIMES, CHAMPION TWO-YEAR-OLD ABERDEEN ANGUS STEER, ALL BREEDS COMPETING.

(Bred and fed by Stanley R. Pierce, Creston, Ill.)



INTERNATIONAL LIVE STOCK EXPOSITION.—WOOD'S PRINCIPLE, CHAMPION UNDER ONE YEAR OLD, ALL BREEDS COMPETING. HEREFORD.

(Shown by George P. Henry, Goodenow, Ill.)



INTERNATIONAL LIVE STOCK EXPOSITION.—WOOD'S PRINCIPLE, CHAMPION UNDER ONE YEAR OLD, ALL BREEDS COMPETING. HEREFORD.

(Shown by George P. Henry, Goodenow, Ill.)

INTERNATIONAL LIVE STOCK EXPOSITION.—GRAND CHAMPION CARLOAD OF GRAIN-FED STEERS.

(Bred and fed by L. N. Kerrick, Bloomington, Ill.)

INTERNATIONAL LIVE STOCK EXPOSITION.—CARCASS OF GRADE HEREFORD STEER BIG HOOKER.

Number, breed, average weight, and price per hundredweight of beef cattle sold—Cont'd.

Breed.	Number sold.	Average weight (pounds).	Price per cwt.
Shorthorns	17	1,578	$6.45
Do	15	1,484	6.40
Aberdeen Angus	15	1,487	6.35
Do	1	1,430	6.30
Shorthorns	15	1,410	6.25
Do	15	1,590	6.25
Aberdeen Angus	15	1,665	6.20
Do	15	1,525	6.15
Herefords	3	1,596	6.15
Aberdeen Angus	15	1,098	6.10
Shorthorns	15	1,542	6.10
Do	15	1,744	6.10
Herefords	17	1,621	6.00
Aberdeen Angus	15	1,544	6.00
Shorthorns	15	1,762	6.00
Hereford heifers	21	1,304	6.00
Herefords	15	1,673	5.95
Do	15	1,606	5.95
Do	15	1,742	5.90
Shorthorn yearlings	2	890	5.90
Galloway yearlings	23	1,052	5.90
Aberdeen Angus heifers	15	993	5.85
Branded Herefords	15	1,569	5.85
Hereford steers and heifers	31	1,353	5.85
Do	31	1,236	5.85
Herefords	16	1,746	5.70
Hereford yearlings	30	666	5.65
Shorthorns	15	1,803	5.60
Aberdeen Angus heifers	16	998	5.50
Shorthorns	15	1,274	5.50
Hereford calves	35	406	5.40
Shorthorns	15	1,048	5.15
Do	15	1,170	5.15
Hereford yearlings	26	883	4.60

At the beginning of the exposition the market for the best cattle was strong, on account, no doubt, of the expected holiday demand, and remained so throughout the week, but the highest prices paid for the exposition stock was the result of a strife between the prominent packers and butchers for advertising purposes. It is the purpose here to consider only the grand champions in the beef lines, and illustrations of each breed, with all the information obtainable as to their preparation, are given.

Plate I shows the grand champion animal Advance, which was also the champion yearling of the exposition, all breeds competing in each case. He was a purebred Aberdeen Angus steer one year and eleven months old, weighing 1,450 pounds, live weight; was raised and fed by the owner, Mr. S. R. Pierce, of Creston, Ill., and was in every respect an ideal representative of the breed which has been so potent a factor in the improvement of the common grades of cattle throughout the country. His preparation for the exposition can be summed up in a few words by the owner: "He was taught to eat oats while sucking his dam, and was weaned at four months old, when he was put on a ration consisting of corn meal, bran, and oil meal, and allowed to run on pasture in season. In winter the same grain ration was continued, with the addition of a few roots, corn fodder, and hay, but seven weeks previous to the exposition 5 pounds of commercial stock feed was added to his daily ration. He was sold at auction for $1.50 a pound, live weight, the highest price ever paid for an animal for beef. Advance was well filled out, carrying his fat evenly distributed over his body. There was an absence of the bunches which are so commonly observed on fat cattle in his condition and which are found frequently on older cattle. He had a medium to thick mellow hide, with a fine coat of glossy hair, which is an indication of a good feeder. He dressed 72 pounds to the hundred pounds of live weight.

Good Times (Pl. II), the two-year-old champion of the show, all breeds competing, was two years and eleven months old, weighing 1,420 pounds, live weight; was raised by Mr. Pierce, the owner of Advance, and was fed in practically the same way that Advance was fed. Although a year older, he did not possess the additional weight which one might expect from a year of additional feeding, but he was, nevertheless, placed second in the grand champion contest. He was put in the slaughter test and dressed 69.09 pounds to the hundred pounds of live weight, but failed to get a place on account of his overripe condition, as was generally the case with winners on the hoof.

Wood's Principle (Pl. III) was the champion calf of the show, all breeds competing. He is a purebred Hereford, fourteen months old, bred and fed by the owner, Mr. George P. Henry, of Goodenow, Ill., and weighed 1,070 pounds. He was taught to eat grain while sucking his dam, his ration consisting of equal parts of corn meal, oats, and bran, with a little oil meal. He was allowed to suck until he was eight months old, when the above ration was continued, with the addition of a few roots. This is a very well-proportioned calf, carrying his width well back, a well-sprung rib, a soft mellow hide, covered with a thick coat of hair. This latter characteristic is much to be desired, and is one of the important factors which has brought this breed to the front as "good rustlers." In the Northwestern States, where early spring and late fall grazing is practiced, an animal with a good thick covering is required. He also affords a good example of early maturity.

Plate IV shows 15 head of the grade Aberdeen Angus steers under three years old, averaging 1,492 pounds live weight. They were fed and bred by the owner, Mr. L. H. Kerrick, of Bloomington, Ill., and were the grand champion carload lot of the show. The lot was very uniform, there being practically no difference as to size, weight, or color, and had from three-fourths to fifteen-sixteenths of the Aberdeen Angus blood in them. They were fed on a ration consisting of corn meal, oats, bran, oil meal, hay, and grass when in season. Mr. Kerrick has been very successful as a breeder and feeder, having topped the market on several previous occasions with cattle of this same breeding, thus demonstrating what can be accomplished by breeding in the same line and by using a purebred sire. This lot was sold for $15.50 per hundred pounds, the highest price ever paid for a single carload lot in this country for beef.

In the slaughter test were 23 animals, consisting of 13 two-year-olds and 10 yearlings. Not in a single instance did a champion on the hoof show its superiority in the carcass test, not to the extent of getting a place in the final enumeration. The illustrations (Pls. V, VI) showing the dressed animals are produced for the purpose of showing the difference between a ripe and an overripe carcass. The first of the two shows the carcass of a two-year-old grade Hereford weighing 1,925 pounds on hoof and dressing 72.09 pounds to the hundred. The second one shows the carcass of a yearling grade Shorthorn weighing 1,495 pounds on the hoof and dressing 69.09 to the hundred pounds, live weight. The latter carcass, being first in its class, was champion carcass of the show. In comparing the two, it can readily be seen that the percentage of fat to lean meat in the former is excessive and was pronounced as being, from a butcher's standpoint, the most wasteful carcass in the contest, while the Shorthorn carcass, grand champion of this contest, although 100 pounds heavier, live weight, than any of his competitors, was fifth in percentage of dressed meat, but on account of the uniformity of the distribution of fat and the general appearance and quality of his meat, was placed first.

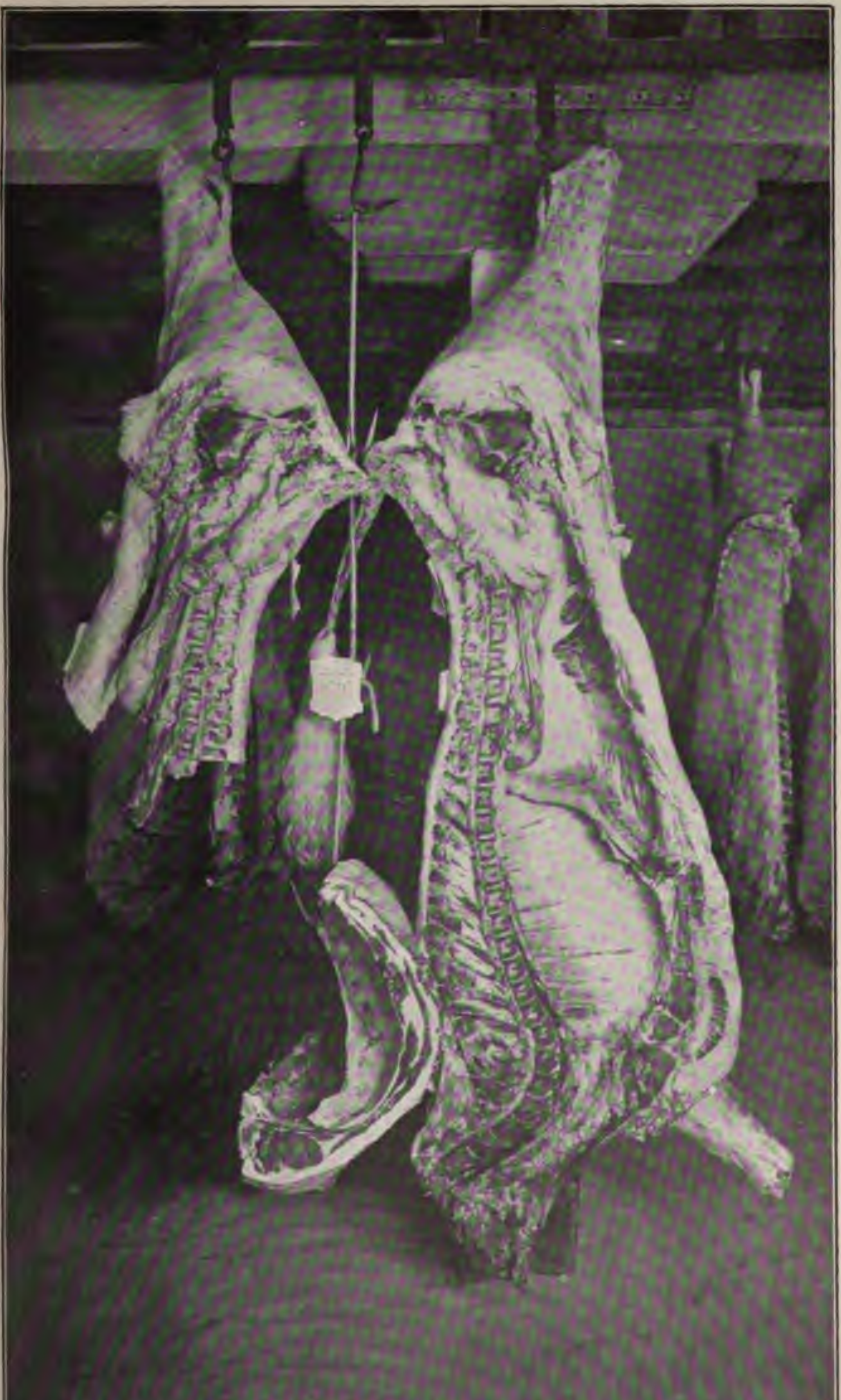
At the Smithfield Show of England in 1892, 23 two-year-old steers of the beef breeds dressed an average of 66.4 pounds to the hundred, while the average of 13 two-year-old steers in this test was 67.86 pounds to the hundred, showing that our feeding is equal to that of the famed grain and root feeding of Great Britain. In an experiment conducted several years ago at the Iowa Experiment Station with 18 head of high grades, representing 9 different breeds of beef and dairy cattle, it was found in comparing the amount of tallow and offal in the two most extreme cases that a Jersey carcass weighing 747 pounds had 190 pounds of loose tallow, while the carcass of a Hereford weighing 1,062 pounds had only 131 pounds of loose tallow. The market value of the former was $4.50 per hundred, live weight, while that of the latter was $6.62½, a difference of $2.12½, notwithstanding the fact that the cattle were fed on the same ration and handled the same way in every respect. The distinguishing difference was that the dairy breeds failed to put the meat on the prime parts, and the fat was very unevenly distributed throughout the body. A buyer, in putting a price on an animal, takes particular notice of the amount of flesh carried on the parts from which the high-priced cuts are obtained, and rates the price accordingly.

This experiment affords a good object lesson of what the quality of a profitable feeder should be. Too little attention is given by our feeders in the selection of their feeding steers at the beginning of the feeding period, and inferior animals are fattened only at the expense of the better ones.

As an object lesson at the exposition, the winners in the grand champion classes were a success, and no steer-feeding records have given us better results. They were magnificent show animals, a triumph of breeding and feeding, but their advent at the exposition gives us no exact information whatever regarding their production. We learn nothing of the amount of feed that was required to produce a pound of the champion beef, nor is there anything whatever to indicate the methods pursued in feeding them, or what are the most economical methods by which grain and grasses may be turned into higher selling products.

The "patent" stock food used in some cases may have been valuable when the animals were being finished, but we were not informed as to its composition, or to the effect it had upon the animals, nor were we given any indication regarding its value as a feeding stuff. Whether their blood, the art of the feeders, or the ration given deserves the credit remains unknown so far as the public is concerned. When so many people are vitally interested in turning the crops of the farm into higher selling products, and so much money is paid in premiums at an exhibition of this kind, it would seem reasonable that exact reports regarding the character of feed that was given during the several months of the animal's existence, how it was fed, and the influence exerted, should be furnished for the general benefit of the industry. This fact will be observed, however, that the best results were obtained with animals ranging from twenty-four to thirty months of age. Steers which are well fed up to this age meet the requirements of the market; therefore early maturity is an important factor in beef production.

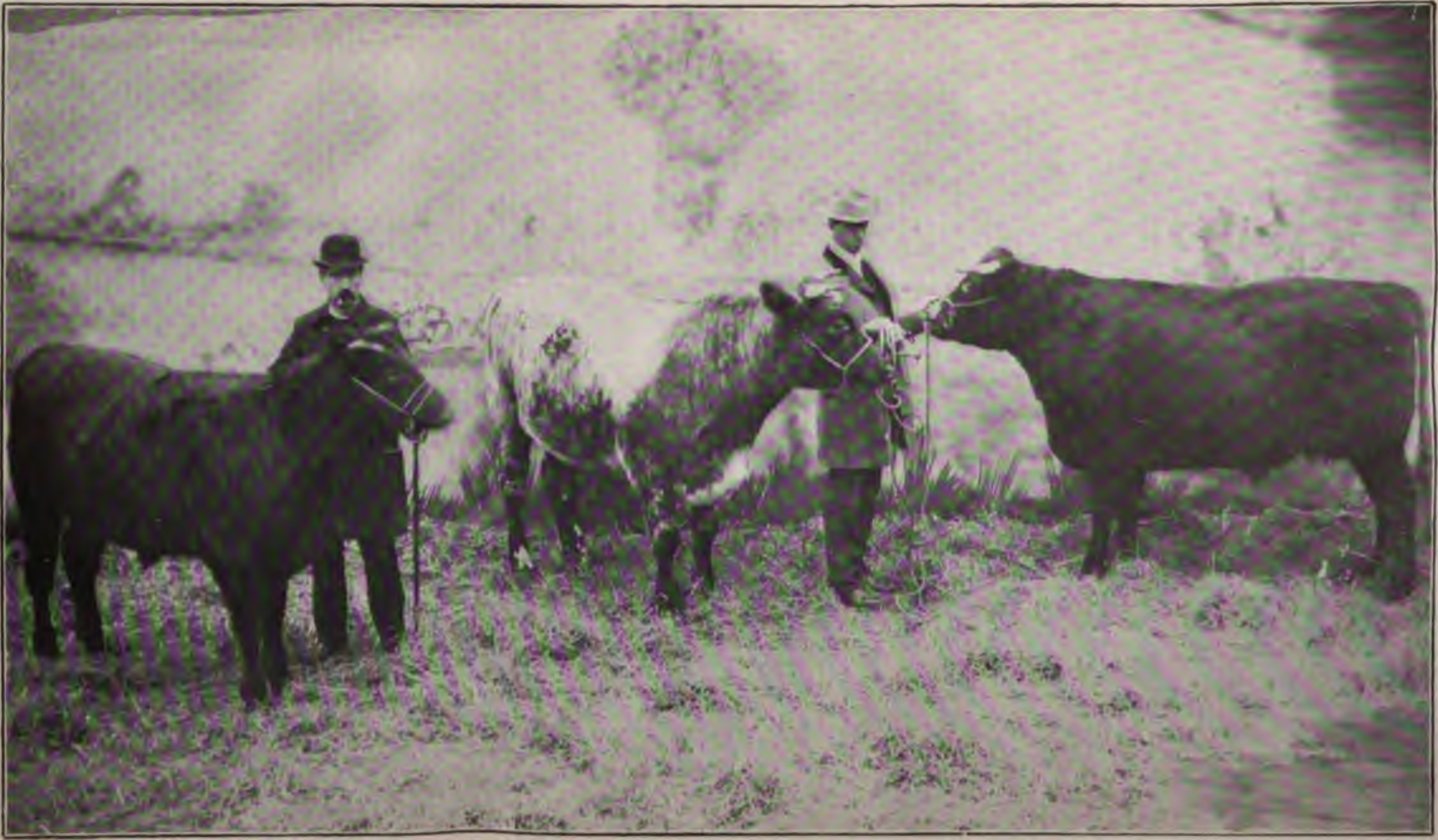
The agricultural colleges and experiment stations had on exhibition a very choice selection of animals, consisting of 41 head of cattle, 34 head of sheep, and 62 head of hogs, making a total of 137 head. This exhibition was classed by itself because, while being eligible in other classes, the entries were the sole competitors for the Clay, Robinson & Co.'s special prize money, amounting to $1,000, to be awarded to students or some regular employee of the above-mentioned institutions. Minnesota, Wisconsin, Iowa, and Michigan were represented. Each institution succeeded in taking premiums, but the best collective exhibit was awarded to Minnesota.



INTERNATIONAL LIVE STOCK EXPOSITION.—CHAMPION CARCASS OF GRADE SHORTHORN STEER SAM.

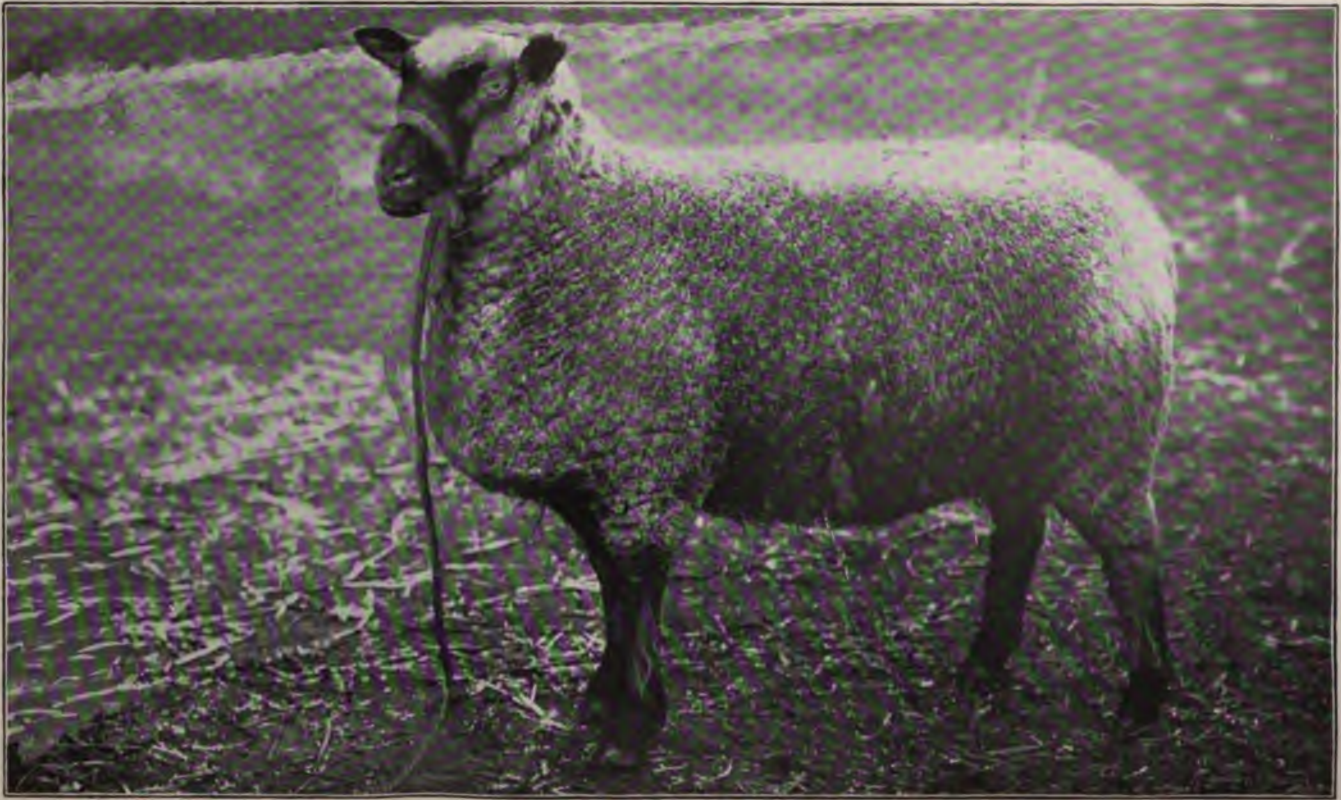
(Shown by M. F. Bunker, Tipton, Iowa.)

PLATE VII.



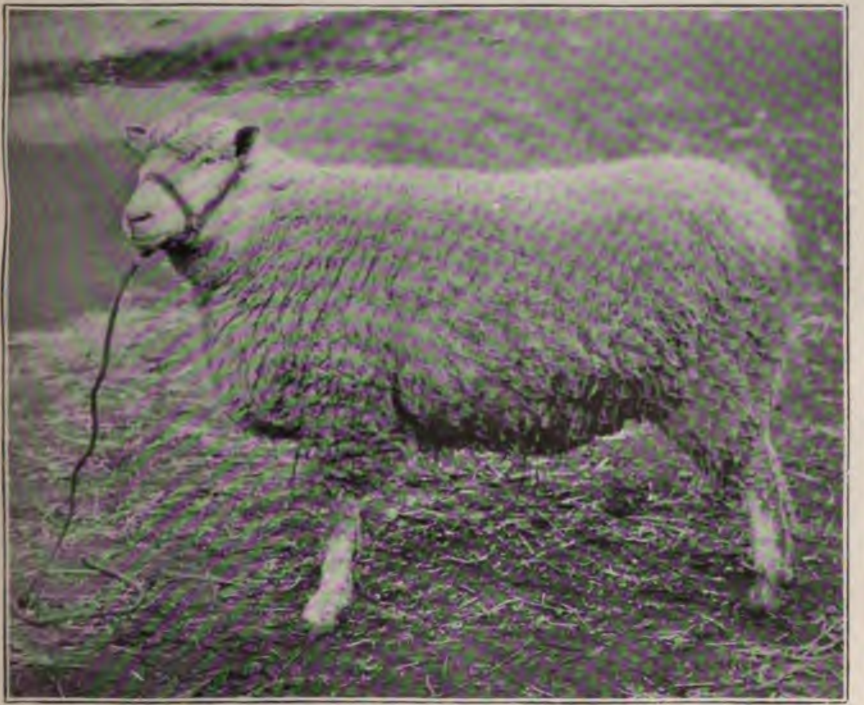
INTERNATIONAL LIVE STOCK EXPOSITION.—FIRST PRIZE GROUP OF SHORTHORN STEERS, CONSISTING OF TWO-YEAR-OLD, YEARLING, AND CALF.

(Exhibited by Abram Renick, Sycamore, Ky.)



INTERNATIONAL LIVE STOCK EXPOSITION.—CHAMPION WETHER IN COMPETITION WITH ALL GRADE AND CROSSBRED WETHERS OF THE MEDIUM WOOL OR DOWN TYPE, UNDER TWO YEARS OLD.

(Exhibited by John Campbell, Woodside, Ontario.)



INTERNATIONAL LIVE STOCK EXPOSITION.—CHAMPION WETHER IN COMPETITION WITH ALL GRADE OR CROSSBRED WETHERS OF THE LONG-WOOLED TYPE UNDER TWO YEARS OLD.

(Exhibited by John Campbell, Woodside, Ontario.)

THE WORK AGAINST SHEEP SCAB.

By D. E. Salmon, D. V. M.,
Chief of Bureau of Animal Industry.

The act of March 2, 1895, designated sheep scab as one of the contagious diseases of domestic animals; and the Bureau of Animal Industry was charged with the duty of inaugurating and enforcing measures for the extermination of the disease. Accordingly regulations were issued on December 13, 1895, which specified that such animals shall not enter into interstate trade or into any stock yards or other places where animals are handled for interstate trade. Notwithstanding these provisions the regulations were quite generally ignored and the disease was as prevalent as before.

The work against scab was renewed by B. A. I. Order No. 5,[1] concerning the transportation of infected sheep, which was issued June 18, 1897. This order recites that sheep scab exists in the United States and that it is a violation of law to receive for transportation or to transport any sheep affected with the disease from one State into another State or Territory. Transportation companies are required to disinfect their cars, boats, or other vehicles, and inspectors of the Bureau are directed to see that the order is carried into effect. Some progress was made along this line, but not to such an extent as to be entirely satisfactory. Conditions arose which made it necessary to issue B. A. I. Order No. 38, concerning the dipping of sheep affected with scabies. This is dated July 20, 1899, and is as follows:

> Whereas the shipment of live stock affected with any contagious, infectious, or communicable disease from one State or Territory to another, or from any State into the District of Columbia, or from the District into any State, is prohibited by the act of Congress approved May 29, 1884; and
>
> Whereas the contagious disease of sheep known as scabies, or scab, exists in many parts of the United States, due notice of which was given in the Department order of June 18, 1897; and
>
> Whereas some of the preparations in which diseased sheep have been dipped by owners and stock-yard companies, with the object of destroying the contagion and making legal the shipment of said sheep in interstate trade, have proved inefficient, and said sheep have disseminated the contagion notwithstanding such treatment; and
>
> Whereas the damage and losses from scabies in sheep have been in some sections very heavy and discouraging to those engaged in the sheep industry—
>
> *It is ordered*, That from and after August 10, 1899, no sheep affected with scabies, and no sheep which have been in contact with others so affected, shall be allowed shipment from one State or Territory into another, or from any State into the District of Columbia, or from the District into any State, unless said sheep shall have first been dipped in a mixture approved by this Department.

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[1] See Report of B. A. I., 1897, pp. 151 and 418; also B. A. I. Bul. No. 21, p. 59.

> The dips now approved are:
>
> 1. The tobacco-and-sulphur dip, made with sufficient extract of tobacco to give a mixture containing not less than five one-hundredths of 1 per cent of nicotine and 2 per cent flowers of sulphur.
>
> 2. The lime-and-sulphur dip, made with 8 pounds of unslaked lime and 24 pounds of flowers of sulphur to 100 gallons of water. The lime and sulphur should be boiled together for not less than two hours, and all sediment allowed to subside before the liquid is placed in the dipping vat.
>
> The owner of the sheep is privileged to choose which one of the above-mentioned dips shall be used for his animals. The Department will instruct inspectors to enforce due care in dipping sheep, but it assumes no responsibility for loss or damage to such animals, and persons who wish to avoid any risks that may be incident to dipping at the stock yards should see that their sheep are free from disease before they are shipped to market.

The requirements of this order brought the Bureau more closely in touch with the work of eradication of sheep scab, and an earnest effort has been made to effect this eradication in the best possible manner. Much evidence is received which shows that good progress is being made, and that the day need not be far distant when sheep scab, like contagious pleuropneumonia, will be a record of the past in the United States.

It was early developed in the progress of the work that more satisfactory results could be obtained by providing for inspection upon the ranges. Therefore during the season of 1900 special sheep inspectors were stationed at Bismarck, N. Dak.; Fremont and Grand Island, Nebr.; Douglas and Cheyenne, Wyo.; Fort Collins, Colo.; Las Vegas, N. Mex.; Pocatello and Soda Springs, Idaho; Ogden, Salt Lake City, and Provo, Utah; Spokane, Wash.; Pendleton, Oreg.; and Reno, Nev. In addition, the inspectors at the following-named stations have given special attention to the inspection of sheep: Buffalo, N. Y.; Pittsburg, Pa.; Cincinnati, Ohio; Louisville, Ky.; Indianapolis, Ind.; Detroit, Mich.; Chicago, Aurora, and National Stock Yards, Ill.; South St. Paul, Minn.; South Omaha and Lincoln, Nebr.; South St. Joseph and Kansas City, Mo.; Fort Worth, San Antonio, Del Rio, El Paso, and Quanah, Tex.; El Reno, Okla.; Flagstaff and Benson, Ariz.; Albuquerque, N. Mex.; Portland, Oreg.; and Tacoma and Seattle, Wash.

Whenever these inspectors examine a flock of sheep a report is made and forwarded to headquarters at Washington. The form is as follows:

REPORT OF SHEEP INSPECTED.

Where inspected ....
Date ...., 190 .

No. inspected ....
No. passed ....
No. rejected for scabies ....
Action taken ....
For feeding? breeding? slaughter?

Were cleaned and disinfected cars provided? ....
Owner ....
Address ....
Shipped from ....
Railroad shipped over ....
Car Nos. and initials ....
....
....
Consignee ....
Address ....
Destination ....
....
No. certificate (if issued) ....

....
Inspector.

N. B.—This form must be used to report sheep inspected, whether shipped or not.

If the dipping of a flock of sheep is done under the supervision of inspectors, the following blank is used for reporting the work to headquarters:

REPORT OF DIPPING OF SHEEP AND OF RECEIPT OF SCABBY SHEEP.

Place ....
Date .... 190 .

No. in infected shipment............ No. dipped.........
Was disease advanced?..
No. exposed sheep dipped ....
Dip used..
Sold for feeding? breeding? slaughter?
Cars cleaned and disinfected after unloading?............
Shipper..
Address ....
Shipped from ....
Railroad shipped over ....
Car Nos. and initials..
....
....
Consignee..
Buyer ....
Address ....
Destination ....
No. certificate (if issued)..

....
Inspector.

N. B.—This form must be used to report the receipt of scabby sheep, whether dipped or not.

When scabies is not present the name of railroad, car numbers, and initials need not be given.

These reports, having been compiled for the year 1900, show that the number of scabby sheep received at various cities was 264,874. The greatest number of such diseased sheep was received at Omaha, there being 52,026 head, while Kansas City is second, with 49,089, various places in Nevada with 39,009, and Chicago with 38,573.

Number of scabby sheep received at various points during the year 1900.

Place.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Chicago		4,909	9,191	11,559	689		85		498	834	3,711	7,097	38,573
Kansas City, Kans	9,089	2,448	3,879	1,758	5,479	3,294	7,707	4,304	1,416	1,174	5,435	3,106	49,089
South Omaha	6,867	6,376	5,940	6,312	4,005	1,451	21	5,384	8,293	536	1,786	5,055	52,026
National Stock Yards	103		1,888	6,748	3,445	4,454							16,638
Cincinnati	409	322	77		90		155	852	79	205			2,189
South St. Joseph	2,762	1,243	481	220		271	1,216	1,701		110	2,336	1,785	12,125
South St. Paul	31		115						101	225			472
Buffalo	105	444	118	525	397					115	33	109	1,846
Various places in Nebraska	922	2,122	997	2,220	2,669	722		275			3,436	796	14,159
Indianapolis	47				127								174
Sioux City										286			286
Various places in Kansas						154							154
Portland, Oreg									65	164	922		1,151
Various places in Wyoming									1,268	6,882	9,036		17,186
Lincoln									2,997				2,997
Various places in Nevada									18,705	15,290	1,543	3,471	39,009
Various places in Utah										2,100	2,250	124	4,474
Various places in New Mexico										2,110	8,516		10,626
Various places in Arizona												1,700	1,700
Total	20,335	17,864	22,686	29,342	16,901	10,346	9,184	12,516	33,422	30,031	39,004	23,243	264,874

Number of sheep dipped during 1900—Continued.

Place.	May.		June.		July.		August.	
	Exposed.	Infected.	Exposed.	Infected.	Exposed.	Infected.	Exposed.	Infected.
Chicago	3,262		10,177		21,153		69,745	
Kansas City, Kans	5,553	810	5,475	1,086	10,594		17,437	2,427
South Omaha		434	1,201	599	6,171		82,035	4,250
National Stock Yards	828	88	4,226		3,005		6,393	
Cincinnati	277	55	1,616		2,484		7,627	677
Louisville			1,274		1,787		2,157	
South St. Paul								
Buffalo	266		1,274		1,413		2,897	
Indianapolis		127						
South St. Joseph				251		296		1,787
Lincoln	403							
Parsons, Kans				154				
Fremont, Nebr				722				
Various places in Nebraska								
Sioux City								
Various places in Arizona								
Various places in Utah								
Various places in Wyoming								
Various places in Nevada								
Various places in New Mexico								
Various places in Idaho								
Various places in Montana								
Total	10,589	1,514	25,243	2,812	46,607	296	138,291	9,141

Place.	September.		October.		November.		December.		Total.	
	Exposed.	Infected.	Exposed.	Infected.	Exposed.	Infected.	Exposed.	Infected.	Exposed.	Infected.
Chicago	60,668	200	80,410	46	32,825	960	5,743	415	283,983	1,704
Kansas City, Kans	21,887	123	37,248	491	13,343	1,972	7,822	1,040	132,038	13,294
South Omaha	47,608	4,022	80,391	358	27,980	1,414	13,839	4,655	210,184	18,754
National Stock Yards	2,850		2,001		1,366				20,969	88
Cincinnati	4,460	7	2,082	6	271				18,817	745
Louisville	451						155		5,824	
South St. Paul	772	100	599	221					1,371	596
Buffalo	4,638		4,724		1,827				17,039	
Indianapolis										127
South St. Joseph	2,541		5,290		1,338	682	714	133	9,946	3,149
Lincoln		2,997							403	2,997
Parsons, Kans										154
Fremont, Nebr										6,417
Various places in Nebraska	2,587		7,665		23,226	3,610	1,079	796	34,557	6,566
Sioux City	2,769	864	10,690	412	5,405		708		19,572	1,276
Various places in Arizona			5,112					1,700	5,112	1,700
Various places in Utah			2,800	2,100		1,500		124	2,800	3,724
Various places in Wyoming		1,268	16,932	19,417		9,036		5,420	16,932	35,141
Various places in Nevada	11,710	15,679	5,698	1,331	1,455	88	2,425	445	21,288	17,543
Various places in New Mexico						10,626				10,626
Various places in Idaho			5,916	2,100					5,916	2,100
Various places in Montana			159	820					159	820
Total	162,941	25,260	267,717	27,302	109,036	29,888	32,485	14,728	806,910	127,521

An idea of the importance of the work done in the matter of inspecing sheep at or near points of origination may be had from a statement furnished by George S. Hickox, agent of this Bureau, to Gov. Heber M. Wells, of Utah, and Hon. Jesse M. Smith, president of the Wool Growers' Association of Utah. This statement covers the last six months of 1900, and was prepared with the purpose ultimately of presenting the facts to the National Live Stock Association, which was to meet in Salt Lake City in January following:

GENTLEMEN: In accordance with your request I have the honor to submit for your information a statement of the work performed by the Department of Agriculture, Bureau of Animal Industry, in the inspection of interstate shipments of sheep in Utah and adjacent States from July 8 to December 15, 1900:

Inspection of sheep in Utah and adjacent States, July–December, 1900.

State.	Passed.	Rejected.	Dipped.	Total inspections.
	Number.	*Number.*	*Number.*	*Number.*
Utah *a*	350,931	8,322	4,964	359,253
Idaho *b*	569,415	13,259	7,216	372,474
Wyoming *c*	529,450	76,336	38,647	605,786
Nevada *d*	209,471	50,512	26,238	259,983
California	5,992			5,992
Oregon	27,395			27,395
Washington	43,900			43,900
Montana	23,185			23,185

a Three yards cleaned and disinfected.
b Six yards cleaned and disinfected.
c Twelve yards cleaned and disinfected.
d One yard and 295 cars cleaned and disinfected.

In performing this service there were nine Federal inspectors engaged.

We have had the willing cooperation of practically all the railroads of the entire West.

It has been found that shippers segregate scabby sheep from their herds and ship the balance without dipping. This is a violation of the Federal law, and such practice should be discouraged by the National Live Stock Association. If, upon reexamination at Missouri River points such sheep should be found scabby through this exposure it will result not only in an additional expense to the shipper, but may throw his stock upon an undesirable market.

Too much care can not be exercised in the dipping of sheep. My observations have been that while the material used is up to the standard the average man will allow the sheep to swim directly through the vat, consuming, in most cases, not more than thirty-five or forty seconds, while the regulations require two minutes. Experience has also taught me that one dipping will not cure scab in all cases If the sheep are scabby they should be dipped twice, with an interval of ten days.

These suggestions are given merely that they might be brought before the association.

Respectfully submitted.

GEO. S. HICKOX, *Agent.*

That the work of the Bureau for the eradication of sheep scab is along proper lines is shown in the reports above, and many who are interested in the sheep industry attest their appreciation in their correspondence with the Bureau officials. For instance, Mr. F. B. Godding, president of the Wool Growers' Association of Idaho, who is authority for the statement that from 50,000 to 75,000 sheep are annually "trailed" into Idaho from Oregon, and that fully 100,000 enter the State for grazing from Nevada, Utah, and Wyoming, writes as follows:

> I am much in favor of the General Government doing this work, for it must be admitted that your work in the West this year has done more to clean up the scab than all the State authorities combined. For the first time our sheep men realize that they must have clean sheep if they want to go to market, and there has been an effort made by them such as I never saw before to dip their sheep carefully. This has had a good effect.
>
> The great trouble in Idaho has been that the deputy sheep inspectors, who do all the work of inspecting, have to depend on the sheep men for their appointment, and the result is that the law is not enforced as it should be, in a great many cases. Under this system the scab was on the increase until you came upon the scene with your Government inspectors; and I want to say for them that they did their work well and with a firmness that carried conviction that they were here to enforce the orders of the Department to the letter—to see that no scabby sheep found their way to the Eastern markets.
>
> While it is true that the expense will be heavy for the first two years, it is my judgment that this is the only way that scab can be cleaned up in these Western States. I believe a proper enforcement of the laws by the General Government for the next four years would clean up every case of scab in the United States.

Mr. T. B. Hord, of Central City, Nebr., says.

> I think the work done by the General Government is invaluable to the sheep industry, and believe that feeders can testify better than any other class of people as to the value of this work. Of course, the railroad people would not have taken pains for us which they have done had it not been for the law compelling them in effect to do it for us.

The following is from Mr. A. J. Knollin, of the firm of Knollin & Co., Kansas City, Kans.:

> I consider that under Government inspection more has been accomplished in one year towards eradicating the scab than could ever be accomplished by local scab laws. I trust that the good work you have started will be enlarged upon by the Bureau.

A petition received by the Bureau recites that in an area of about 20 by 25 miles in the counties of Larimer and Weld, Colorado, there are fed every year about 300,000 lambs, chiefly for the Chicago market; and the petitioners, 95 in number, ask for the appointment of an inspector to be located at some point convenient to these feeding grounds, and whose duty it shall be to inspect all sheep before shipping. Their petition contains the following paragraph:

> As feeders and shippers of sheep we are pleased with the efforts being made by you to eradicate the disease known as scabies, and are willing and desirous of rendering you any assistance in this matter that is within our power.

There appears to be a disposition on the part of State authorities to cooperate with the Bureau in its efforts to eradicate the disease of sheep scab. Mr. Hickox in the statement copied above mentions the cordial cooperation of several of the States. Illinois, Colorado, and New Mexico have taken official action, as shown in the orders which they have issued and which are given herewith.

The following was issued by Illinois on April 1, 1899:

Whereas scabies, a dangerously contagious disease among sheep, prevails among the sheep of this and other States, and

Whereas, in the opinion of the attorney-general of Illinois, contagious diseases of sheep come within the jurisdiction of this board, and

Whereas the United States Bureau of Animal Industry is endeavoring through the cooperation of the various State veterinary sanitary authorities to suppress and prevent the spread of said disease; therefore, be it

Resolved, That the following regulations be, and the same are hereby, adopted:

No. 1. No sheep shall be shipped from any stock yards in this State to any points within the State for the purpose of feeding or grazing until they shall have been dipped in accordance with the formula and regulations adopted by the United States Bureau of Animal Industry and enforced by said Bureau in all cases of interstate shipments.

No. 2. Any sheep affected with scabies, destined for shipment to any point in this State to be fed or grazed, discovered in any stock yards in this State by any member, officer, or agent of this board, State veterinarian, or any assistant State veterinarian, shall be placed in quarantine, and shall not be permitted to be shipped to any point in this State for the purpose of feeding or grazing until after having been satisfactorily dipped, and said sheep shall be maintained in quarantine at their destination until released by order of this board: *Provided*, That nothing in this regulation shall be so construed as to interfere with the free shipment of sheep destined for sale for immediate slaughter between markets in this State.

SHEEP QUARANTINE.

DENVER, COLO., *February 14, 1900.*

From and after this date, and until further notice, the following regulations will govern the admission of sheep from the States of Washington, Oregon, Montana, Idaho, Wyoming, California, Nevada, Utah, and Texas, and the Territories of Arizona, New Mexico, and Oklahoma, and the Republic of Mexico, into the State of Colorado:

First. All sheep intended to be driven or shipped into or through this State from the above scheduled States and Territories must be inspected by the State veterinary sanitary board or by its duly authorized deputies before being allowed to enter said State, and due notice must be given of such intention to the secretary, at the capitol building, Denver, Colo., or to one of the authorized inspectors of this board, except: Sheep from the above-scheduled districts may enter Colorado without inspection or a bill of health, by rail, provided they do not unload in this State, except in quarantine pens for the purpose of feeding and watering and for a period not exceeding twenty-four hours.

Second. No sheep, except as provided for above, will be allowed to be driven or shipped across the State line unless accompanied by a bill of health granted by the State veterinary sanitary board, or by its duly authorized deputies, certifying that such sheep are wholly free from disease, and have not come in contact with any diseased sheep during the preceding sixty days, or unless accompanied by a special permit, which will be granted only on the following conditions:

That sheep so introduced shall be dipped to the satisfaction and under the supervision of the board, or its duly authorized inspectors, at Denver, Pueblo, La Junta, or at such other point as may be designated by said board, before such sheep shall be permitted to reload, or be driven to any point from the point of unloading, and said sheep, if introduced under such special permit, shall be held in quarantine by said board until the above provisions of inspection and dipping are fully complied with.

Third. To defray the expenses of inspection and the necessary supervision a fee of 1 cent per head will be charged before a bill of health is issued, and a fee of 1½ cents per head before a special permit is issued. The latter fee will include the costs of release hereafter granted upon the fulfillment of the terms of the permit.

Fourth. The cars used to transport all sheep coming into this State under special permit, as provided for above, and the pens in which they are unloaded, must be disinfected in the following manner: (*a*) Remove all litter and manure. This litter may be disinfected by mixing it with lime or saturating with a 5 per cent solution of carbolic acid, or if not disinfected it may be stored where no sheep can come in contact with it. (*b*) Saturate the walls and floors of cars, fencing, troughs, and chutes, or pens, with a solution made by dissolving 4 ounces of chloride of lime in 1 gallon of water, or disinfect the cars with a jet of steam under a pressure of not less than 50 pounds to the square inch.

Inspectors will be stationed at the following points: P. J. Towner, East Las Vegas, N. Mex.; H. G. Ballard, Thompsons, Utah; J. A. Slayton, Carr, Colo.; J. B. Walker, Folsom, N. Mex.; J. S. Hoy, Ladore, Colo.; Sheriff J. A. Garcia, Conejos, Colo.; A. McKenzie, Kenton, Okla., and at other points of dipping within the State of Colorado.

The penalty for infringement, or an attempt to infringe upon the provisions of this order, is a fine of not less than $100 nor more than $5,000, or imprisonment for not less than three months nor more than two years, or both.

THE STATE VETERINARY SANITARY BOARD OF COLORADO,
BRADFORD H. DUBOIS, *President.*

DR. SOL. BOCK, *Secretary.*

SHEEP SANITARY BOARD OF NEW MEXICO.

Important order.

ALBUQUERQUE, N. MEX., *June 7, 1900.*

To the sheep growers of the Territory of New Mexico:

You are hereby notified that all sheep which show any signs of having scab must be dipped twice, ten days apart, between now and the 1st of August, 1900, using any standard proprietary dip, such as ———,[1] or the lime-and-sulphur formula heretofore prescribed by this board in its rules and regulations.

Any sheep owner who fails or neglects to comply with this order, and whose sheep have scab after August 1, 1900, will be subject to a fine of 1 cent for each and every head [not] so dipped, and the respective inspectors for the various counties have been ordered to strictly enforce this order, and to collect such fines, and to have all sheep not so dipped, as above ordered, dipped at owner's expense. And in the event of any flock still showing scab after having been dipped twice, the dipping must be continued until the scab is cured.

The board desires to call especial attention to the notice received from the Bureau of Animal Industry of the United States Government, that no sheep will be allowed to leave this Territory that have or show any signs of scab, and that a force of United States Government inspectors have been employed to enforce this order. All growers who fail to take this warning will find they can not dispose of their sheep to leave the Territory, and should see that their sheep are entirely free from scab or they will be unable to make a sale.

SOLOMON LUNA, *President.*

HARRY F. LEE, *Secretary.*

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[1] The names of the proprietary dips are omitted in this report, as to publish them would appear to some extent as an advertisement.—D. E. S.

SHEEP SANITARY BOARD OF NEW MEXICO.

Important order.

ALBUQUERQUE, N. MEX., *October 13, 1900.*

To the sheep growers of the Territory of New Mexico:

You are hereby notified that all sheep which have not been dipped since June 1, 1900, must be dipped between now and the 1st of December, 1900, using any standard proprietary dip, such as ———,[1] or the lime-and-sulphur formula, heretofore prescribed by this board in its rules and regulations. And in the event of any flock still showing scab after having been dipped, the dipping must be continued until the scab is cured.

Any sheep owner who fails or neglects to comply with this order, and whose sheep have not been dipped by December 1, 1900, will be subject to a fine of 1 cent for each and every head not so dipped, and the respective inspectors for the various counties have been ordered to strictly enforce this order, and to collect such fines, and have all sheep not so dipped, as above ordered, dipped at owner's expense.

The board desires to call especial attention to the notice received from the Bureau of Animal Industry of the United States Government, that no sheep will be allowed to leave this Territory that have or show any signs of scab, and that a force of United States Government inspectors have been employed to enforce this order. All growers who fail to take this warning will find they can not dispose of their sheep to leave the Territory, and should see that their sheep are entirely free from scab or they will be unable to make a sale.

SOLOMON LUNA, *President.*

HARRY F. LEE, *Secretary.*

THE EFFECTIVENESS OF DIPS.

By reference to Order No. 38, copied near the beginning of this article, it will be observed that because of the ineffectiveness of many of the dips used it became necessary for the Bureau to require the use of such kinds as it approved before affected or exposed sheep should be allowed to enter into interstate trade. The dips thus approved were:

(1) Tobacco-and-sulphur dip, made with sufficient extract of tobacco to give a mixture containing not less than five one-hundredths of 1 per cent of nicotine and 2 per cent of flowers of sulphur; or (2) lime-and-sulphur dip, made with 8 pounds of unslaked lime and 24 pounds of flowers of sulphur to 100 gallons of water. The lime and sulphur should be boiled together for not less than two hours and all sediment allowed to subside before the liquid is placed in the dipping vat.

The accompanying table shows that under this order three dips were used, namely, nicotine and sulphur, extract of tobacco and sulphur, and lime and sulphur. In order to ascertain the effectiveness of these dips the following circular letter was mailed to the purchasers of sheep that had been dipped in any one of them:

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF ANIMAL INDUSTRY,
Washington, D. C., January 30, 1901.

SIR: This Bureau desires to obtain information showing whether the dipping of sheep for sheep scab in the principal stock yards during the past year was successful in protecting the purchasers. You are therefore requested to fill in and return in inclosed franked envelope, which can be mailed without stamp, answers to the questions printed below.

---

[1] The names of the proprietary dips are omitted in this report, as to publish them would appear to some extent as an advertisement.—D. E. S.

Very respectfully,

D. E. SALMON, *Chief of Bureau.*

(1) How many sheep were dipped for you? and where?
(2) What dip was used?
(3) Did the sheep show signs of scab before dipping?
(4) Were clean stock-yard pens and cars used for the sheep after dipping?
(5) Did you ever have scab on your premises before receiving this lot of sheep?
(6) If so, in what year?
(7) Were the sheds and pens on your premises, occupied by the dipped sheep, cleaned and disinfected before placing sheep in same?
(8) Has scab since appeared among the sheep dipped for you under the supervision of officials of this Department?

Name:
Post-office address:

Replies were received from 753 persons, and the information thus obtained is given in the following table:

Statement showing efficacy of dips used on sheep exposed to and infected with scab.

Dipping station.	Nicotine and sulphur.				Extract of tobacco and sulphur.				Lime and sulphur.				Totals.				
	Effective.		Ineffective.		Effective.		Ineffective.		Effective.		Ineffective.		Effective.		Ineffective.		Grand total.
	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	
Buffalo:																	
Exposed									6,022	90	639	10					
Infected									5	100							
Total									6,027	90	639	10	6,027	90	639	10	6,666
Chicago:																	
Exposed	145,679	92	12,548	8													
Infected	25,273	94	1,527	6													
Total	170,952	92	14,075	8									170,952	92	14,075	8	185,027
Cincinnati:																	
Exposed					8,132	100											
Infected					481	100											
Total					8,613	100							8,613	100			8,613
Kansas City:																	
Exposed	5,630	58	4,020	42	12,338	67	5,984	33	19,450	67	9,783	33					
Infected	1,406	100			10,699	79	2,799	21	11,922	68	5,638	32					
Total	7,036	64	4,020	36	23,037	72	8,783	28	31,372	67	15,421	33	61,445	69	28,224	31	89,669
Louisville:																	
Exposed					1,611	100											
Infected					126	100											
Total					1,737	100							1,737	100			1,737
National Stock Yards:																	
Exposed	3,786	65	2,080	35													
Infected	2,250	100															
Total	6,036	74	2,080	26									6,036	74	2,080	26	8,116

Statement showing efficacy of dips used on sheep exposed to and infected with scab—Continued.

Dipping station.	Nicotine and sulphur				Extract of tobacco and sulphur.				Lime and sulphur.				Totals.				Grand total.
	Effective.		Ineffective.		Effective.		Ineffective.		Effective.		Ineffective.		Effective.		Ineffective.		
	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	
Sioux City:																	
Exposed					11,079	100											
Infected					286	100											
Total					11,365	100							11,365	100			11,365
South Omaha:																	
Exposed					105,444	94	7,036	6	10,532	79	2,741	21					
Infected					30,770	92	2,668	8	4,800	93	364	7					
Total					136,214	93	9,704	7	15,332	83	3,105	17	151,546	92	12,809	8	164,355
South St. Joseph:																	
Exposed	3,655	69	1,680	31													
Infected	2,528	59	1,800	41													
Total	6,183	64	3,480	36									6,183	64	3,480	36	9,663
South St. Paul:																	
Exposed					1,295	91	125	9									
Infected	100	100			400	100											
Total	100	100			1,695	93	125	7					1,795	93	125	7	1,920
Fremont, Nebr.:																	
Exposed					700	100											
Infected											2,446	100					
Total					700	100					2,446	100	700	22	2,446	78	3,146
Grand Island:																	
Exposed									4,500	100							
Infected									796	75	272	25					
Total									5,296	95	272	5	5,296	95	272	5	5,568

Casper, Wyo.:																	
Infected									2,400	100			2,400	100			2,400
Clayton, N. Mex.:																	
Infected									10,570	100			10,570	100			10,570
Cokeville, Wyo.:																	
Infected											3,300	100			3,300	100	3,300
Lincoln, Nebr.:																	
Infected							2,997	100							2,997	100	2,997
Total	190,307	88	23,655	12	183,361	89	21,609	11	70,997	74	25,183	26	444,665	86	70,447	14	515,112

It is shown that 515,112 sheep were dipped in accordance with Order No. 38 at fifteen points; at some points one dip was used, another dip at other points, and at one place (Kansas City) all three were used.

These statistics are exceedingly instructive, but in order to interpret them correctly several important factors must be held clearly in mind, and if one fails to consider these factors the most illogical and misleading conclusions will result.

It may first be recalled that, owing to certain practical trade conditions, the Bureau has thus far insisted only on a single dipping, instead of on two dippings ten days apart. Notwithstanding this concession which has thus far been made to trade conditions, it will be noticed that of 515,112 sheep dipped 86 per cent were effective and only 14 per cent ineffective. It must be confessed that this is a better result on single dipping than even we hoped to obtain, since the treatment had to be performed at so many different places (hence by different sets of men) on which account absolute uniformity could hardly be expected. The 14 per cent of ineffective cases clearly indicates, however, that the period must soon come to an end during which the Bureau can make a temporary concession to traders in order that they may adapt themselves to conditions which they must surely foresee. While many buyers and shippers have cheerfully cooperated with the Bureau in its work of restricting scab, this can not be said of all of them. Those dealers and feeders who endeavor to eradicate the disease are now shown to be subject to a certain amount of risk of failure or reinfection due to the 14 per cent of failure from a single dipping. It is therefore only a question of a short time when the Bureau will find it an absolute necessity, in protecting sheep raisers and feeders, to insist upon a double dipping. Sheep raisers would do well to take this warning seriously, and to double their efforts for the eradication of the disease not only from their own flocks, but from the other flocks in their county. To allow scab to exist in a neighbor's flock, when he is so careless as to ignore the warnings already given, is for the cautious sheep raiser to assume a risk of having his own sheep held for a double dipping in case they come into contact with his neighbor's sheep during shipment.

In comparing the statistics further it is important to note that the difference in results with one and the same dip at different places indicates a different degree of thoroughness in the work performed at the various stations. Thus, all dips considered, the stations rank in percentage relative to effectiveness as follows:

	Per cent.
Cincinnati, Louisville, Sioux City, Casper, and Clayton	100
Grand Island	95
South St. Paul	93
Chicago and South Omaha	92
Buffalo	90
National Stock Yards	74
Kansas City	69
South St. Joseph	64
Fremont	22
Cokeville and Lincoln	0

In this table it will be noted that stations ranking higher than 92 per cent dipped but a comparatively small number of sheep; hence their chances for ineffectiveness were much less than occurred at places like Chicago, South Omaha, and Kansas City.

Making a comparison of the different dips as used at different stations, we obtain the following tables of effectiveness:

Nicotine and sulphur.

	Per cent.
South St. Paul	100
Chicago	92
National Stock Yards	74
Kansas City and South St. Joseph	64

Extract of tobacco and sulphur.

Cincinnati, Louisville, and Fremont	100
South Omaha and South St. Paul	93
Kansas City	72
Lincoln	0

Lime and sulphur, B. A. I. formula.

Casper and Clayton	100
Grand Island	95
Buffalo	90
South Omaha	83
Kansas City	67
Fremont and Cokeville	0

These three tables clearly indicate that the dipping at the different stations was far from uniform; hence that there was a carelessness on the part of some officials in following instructions. Kansas City, for instance, makes a uniformly poor showing with all three dips.

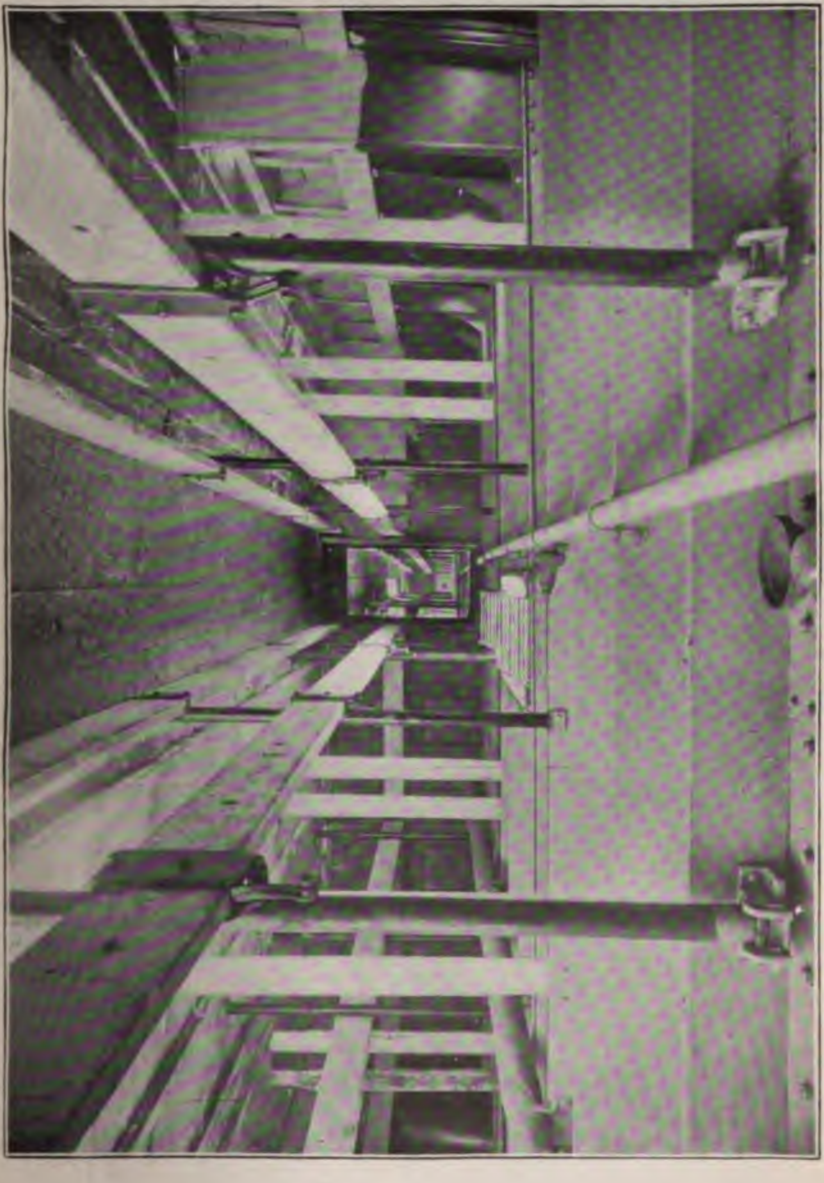
Owing to the difference in results at different stations—hence lack of uniformity of conditions under which all three dips were used—a direct comparison of the totals would be glaringly unjust. If this were made, it would express as follows:

	Per cent.
Nicotine and sulphur	88
Extract of tobacco and sulphur	89
Lime and sulphur	74

Still, we should recall that extract of tobacco and sulphur was 100 per cent effective at three stations; lime and sulphur was 100 per cent effective at two stations; and nicotine and sulphur was 100 per cent effective at one station. The fact that all three dips have given 100 per cent of effective cases in certain lots of sheep is a thorough indication of the position taken by the Bureau, to the effect that the dips in question when properly used are equally efficacious.

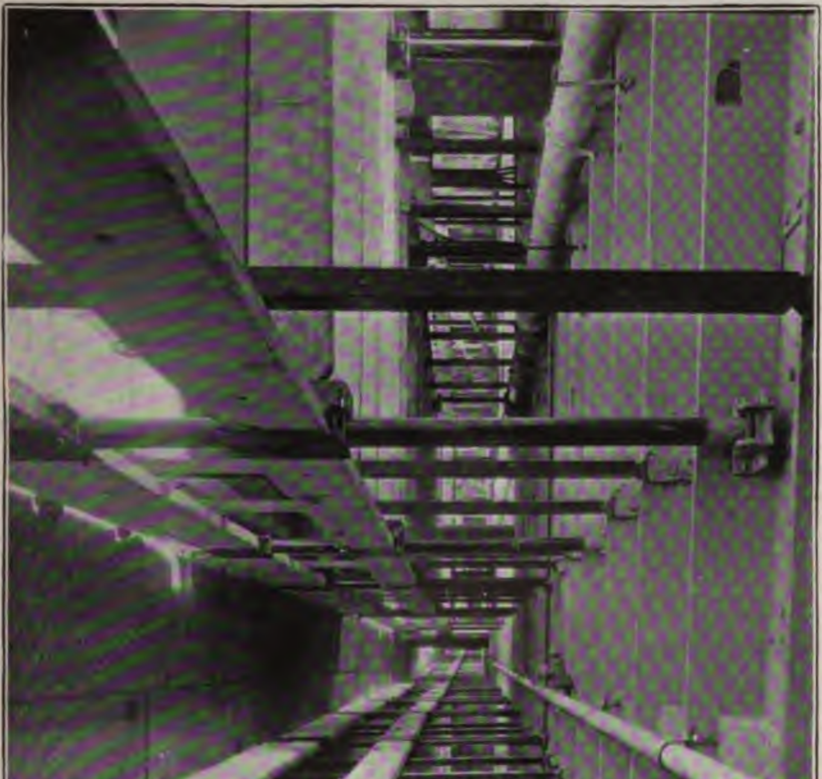
Of all sixteen stations, Kansas City alone used all three dips. It may be assumed that the efficiency or carelessness with which the work was performed was approximately the same with all dips; still, even this seems to have varied, for we find the following variation in effectiveness and in ineffectiveness: Extract of tobacco and sulphur, 72 per cent effective, 28 per cent ineffective; lime and sulphur, 67 per cent effective, 33 per cent ineffective; and nicotine and sulphur, 64 per cent effective, 36 per cent ineffective.

Plate X.

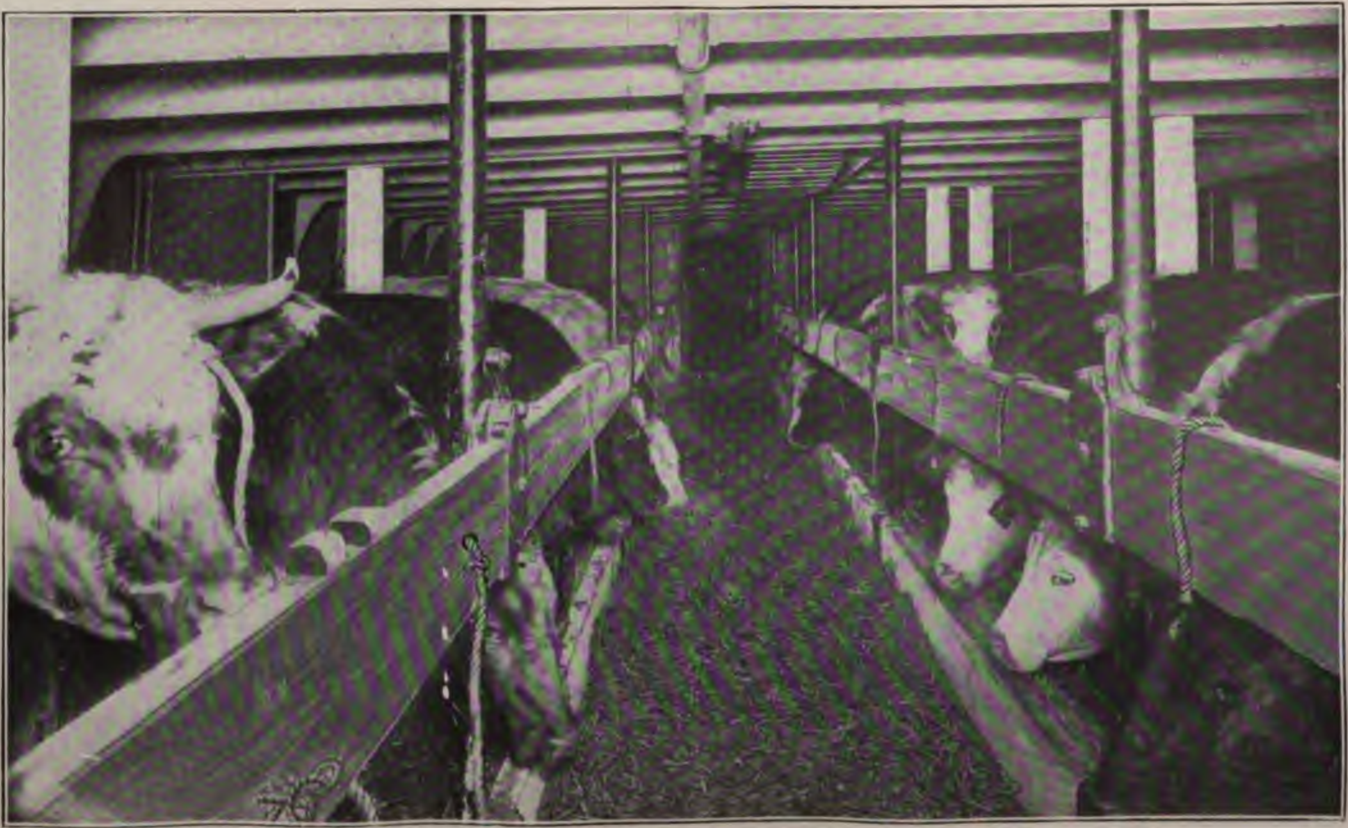


Ocean Transport.—Fitted for carrying Cattle or Horses.

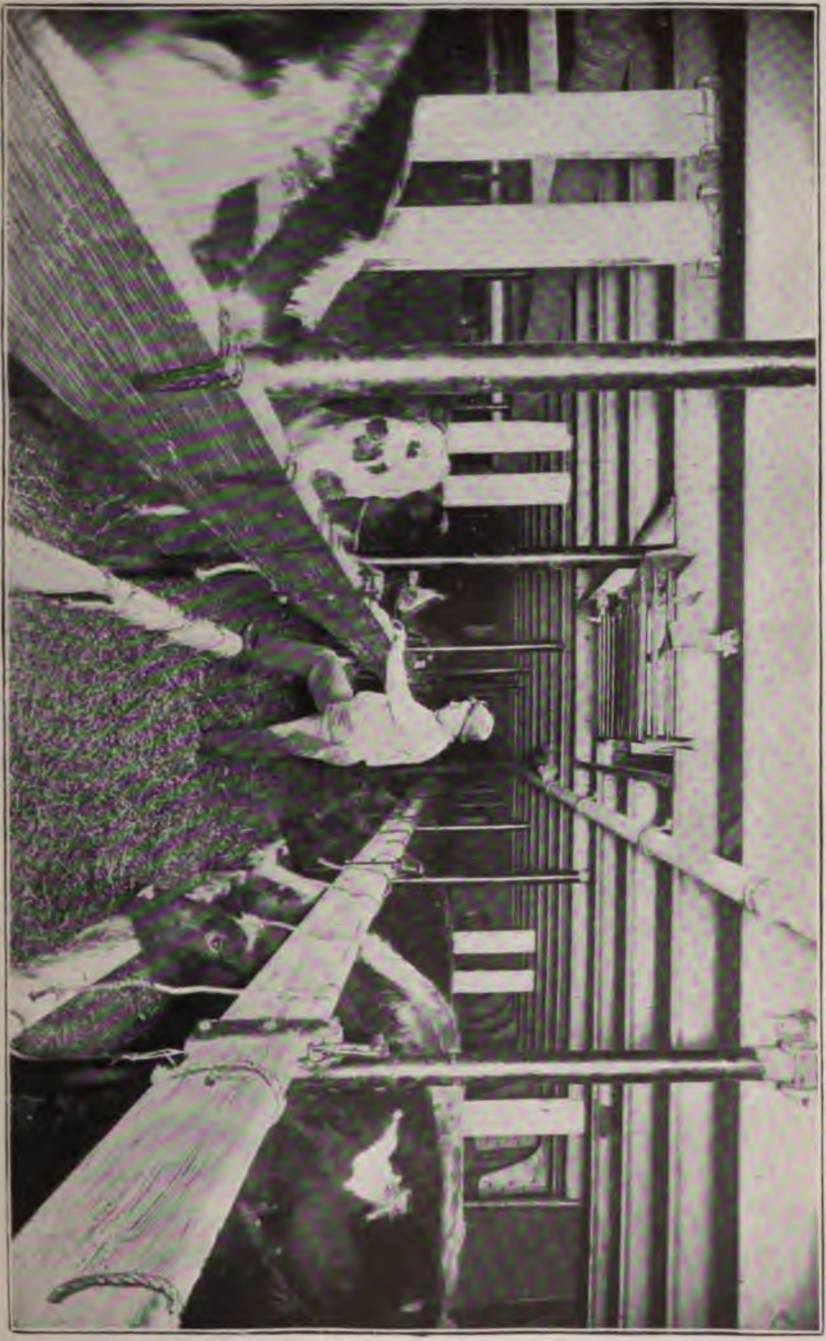
PLATE XI.



OCEAN TRANSPORT.—FITTED FOR CARRYING CATTLE OR HORSES.



OCEAN TRANSPORT.—CATTLE IN PLACE READY FOR SHIPMENT.



OCEAN TRANSPORT.—CATTLE IN PLACE READY FOR SHIPMENT.

OCEAN TRANSPORTATION OF CATTLE AND HORSES.

The Sixteenth Annual Report of this Bureau contained some remarks (pp. 118–120) on the inspection of vessels that carry export cattle. It is there stated that previous to 1891 the losses of cattle at sea were large, a fact which was due principally to the improper construction of ships that were engaged in the trade. The ventilation was very bad, proper facilities for feeding and watering were wanting, space was badly overcrowded, the ships were sometimes unseaworthy, and the attendants were often inexperienced and worthless. The situation was rendered worse by the constant cry of the English press against the so-called cruelties practiced in the ocean shipment of cattle. While the statements made by the press were highly exaggerated, the conditions were altogether so unsatisfactory that Congress felt it necessary to take action, the result of which was the passage of the law of March 3, 1891, providing for the safe transport and humane treatment of export cattle from the United States to foreign countries. The power of supervision of this work was given to the Secretary of Agriculture, and he was authorized to prescribe by rules and regulations or orders the accommodations which said vessels shall provide for export cattle "as to space, ventilation, fittings, food and water supply, and such other requirements as he may decide to be necessary for the safe and proper transportation and humane treatment of such animals."

The regulations issued under this law, having been amended and modified from time to time, provide, so far as the ocean transport service is concerned, for the proper space for the animals. The animals are not allowed to be carried on any part of the vessel where they will interfere with the proper management of the vessel or with the ventilation and light. The manner of carrying food and water is specified, as well as the character of attendants that are employed to look after the cattle. The whole interior fittings of the ship are, indeed, under the supervision of the Department. As these regulations are printed in full elsewhere in this volume, it is not necessary to give even a synopsis here.

The following table is inserted to show how the percentage of losses of cattle has been reduced since the Bureau of Animal Industry has been supervising the cattle ships:

Percentage of losses of cattle at sea, 1891-1900.

Fiscal year.	Per cent.	Fiscal year.	Per cent.
1891[1]	1.6	1896	0.32
1892	.875	1897	.57
1893	.47	1898	.22
1894	.37	1899	.31
1895	.62	1900	.19

[1] Includes four and one-half months of 1890.

Extracts from a recent interview on this subject given to a New York paper by an official of one of the ocean transportation lines have some points of interest and are given herewith:

"When those cattle decks are ready for a load they are rather more attractive than the steerage quarters on most boats." The statement may have been a trifle extravagant, but the speaker was an officer on one of the fast trans-Atlantic freight steamers, and he was proud of his boat. He had reason to be proud of it. One hears a great deal about the improvements in first and second cabin and steerage accommodations that have been made in the last fifteen years, but very few persons not connected with the cattle business have the smallest idea of the revolution that has taken place in the methods of live stock transportation.

Until ten years ago cattle shipment was practically in the hands of the steamship companies and the insurance companies. Now the United States Government has taken a hand in the game, and is running things with cheerful unconcern as to the feelings and profits of the transportation companies.

In the old days there were no good freight boats, but there were varying grades of poor ones. Even on the best steamers the sanitary conditions were lamentable, and cruel overcrowding was the rule. When the foreign market was good and freight rates were high, the owners of outside boats—tramp freights of all sorts—saw an opportunity of making money. They knocked together cattle accommodations of some sort, loaded to the last cubic inch of the capacity of the vessels, and ran them between this country and England.

Of course, there were laws, but they were not enforced. Competition among insurance companies was so keen that if one company cried out against conditions on a boat and refused to insure it another would discreetly shut its eyes and chance the risks. Mortality among the cattle was high and disease was prevalent. Now all that is changed.

"Out of 340,000 head of cattle exported last year not more than one-tenth of 1 per cent were lost," said a representative of one of the fast freight lines to the reporter. "That shows what has been done toward improving freight conditions. The Government is looking out for the cattle and horses now, and it will not stand any trifling or take any chances. The transportation companies have had to come up to requirements or quit.

"Of course, that has driven all the outsiders and tramps out of the business and narrowed the thing down to a few companies. It simply wasn't possible to fit the old boats to Government requirements. New boats had to be built, and they are carrying the freight. Only a very few old boats are carrying cattle at all.

"The Government inspectors don't overlook anything, and the laws they follow don't leave much to the discretion of the steamship companies. The ventilation must be just according to schedule, or not a bullock is allowed to set foot on the boat. A ship is billed to carry cattle. The inspector comes along and goes through it. 'You'll have to knock five more ventilators through that iron deck before you'll be allowed to load,' he says cheerfully, and chalks the places for the ventilators. The owners swear, but that's all the good it does. There's no use bucking against the Government.

"Then the Government regulates the minimum amount of space to be allowed to each animal. There's no chance for overcrowding now. Some of our boats will carry 1,050 head of cattle and horses, but the pens must be built according to rule. Every horse must have a pen at least 2 feet 6 inches wide and 8 feet deep, and only one horse must be put in a pen. The cattle get the same proportion of space, but four bullocks are put together, so that cattle pens are four times as large as those for the horses.

"The lumber used must be of the thickness and width, etc., demanded by Government regulations. The forks, pails, troughs, and everything used in taking care of the animal must be thoroughly disinfected under Government inspection after each voyage. All the boards of the pens must be washed with carbolic acid and freshly whitewashed. The horses' blankets and everything of that sort must be fumigated with sulphur.

"Now, remember that all this is done both in this port and on the other side. Trouble? Well, I should say it is; but it's a mighty good thing all the same. When the boat is ready, it is as clean and fresh as the first cabin staterooms. No matter for how many years a boat has been carrying cattle, her pens are measured carefully each trip, her ventilators are examined, and every detail is gone over as if the inspectors had never seen her before. Uncle Sam intends that our cattle shall land in England in first-class condition, if he can accomplish it.

"The results justify the precautions. It wasn't so very long ago that England kicked about the way Argentina was doing its cattle shipping, and advised the shippers down there to take us as a model. Argentina sent representatives up here to study our ships and our methods. No country in the world handles its cattle and horse shipping as well as we do now.

"The fast freights take only nine days for the trip. They are fitted out with bilge keels and every modern contrivance to insure steadiness, safety, and speed. There are no steadier boats on the ocean. As a matter of fact, they are even steadier than most of the big passenger boats.

"The ordinary garden variety of horse goes into those small stalls. All of the bullocks and horses are tied to that front rail with a special knot that doesn't have to be untied or cut. In the old times, when a ship went over on beam ends, or anything happened to upset things, the cattle almost strangled before they could be untied. Now a little jerk on any of those rope ends will untie the knots and free the brutes."

"Do the shippers send their own men with the cattle?" asked the reporter.

"Usually the Government lays down the law as to how many men must go. The ship company has its own horsemen engaged by the year at very good wages. There is always one very competent headman or superintendent. He bosses things and the other men do the work. Some of the men on this boat have been taking care of our horses for five years. I'm the boss myself. Of course, when fine thoroughbreds are going over, their own grooms and trainers are with them, and they get as much care as a baby."

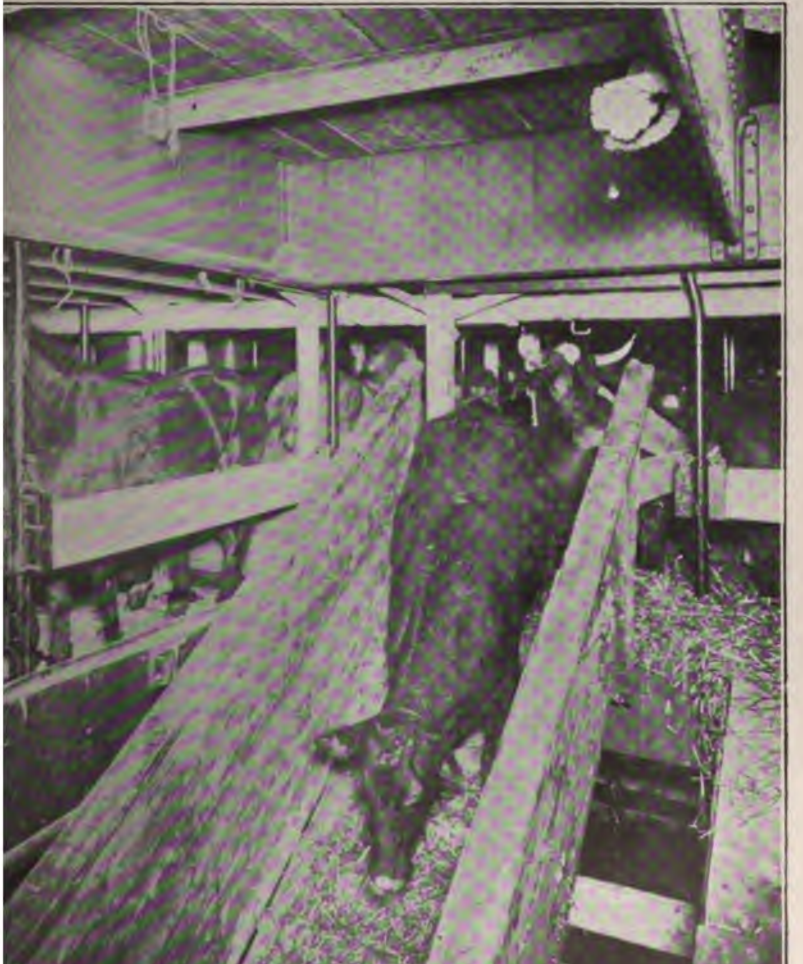
"Do the horses and cattle get frightened and make much disturbance in rough weather?"

"Bless you, no. They've got sea legs that would put an old salt to shame. Occasionally a horse will lose his balance, but a bullock is the greatest balancer you ever saw. They are knowing brutes, too. You know we put them four in a pen. Well, you'll never find all four standing up or lying down at one time. They figure the thing out and decide how they'll get the most room and the most comfort. So two of them stand up while two lie down. When they get tired, they shift the watch.

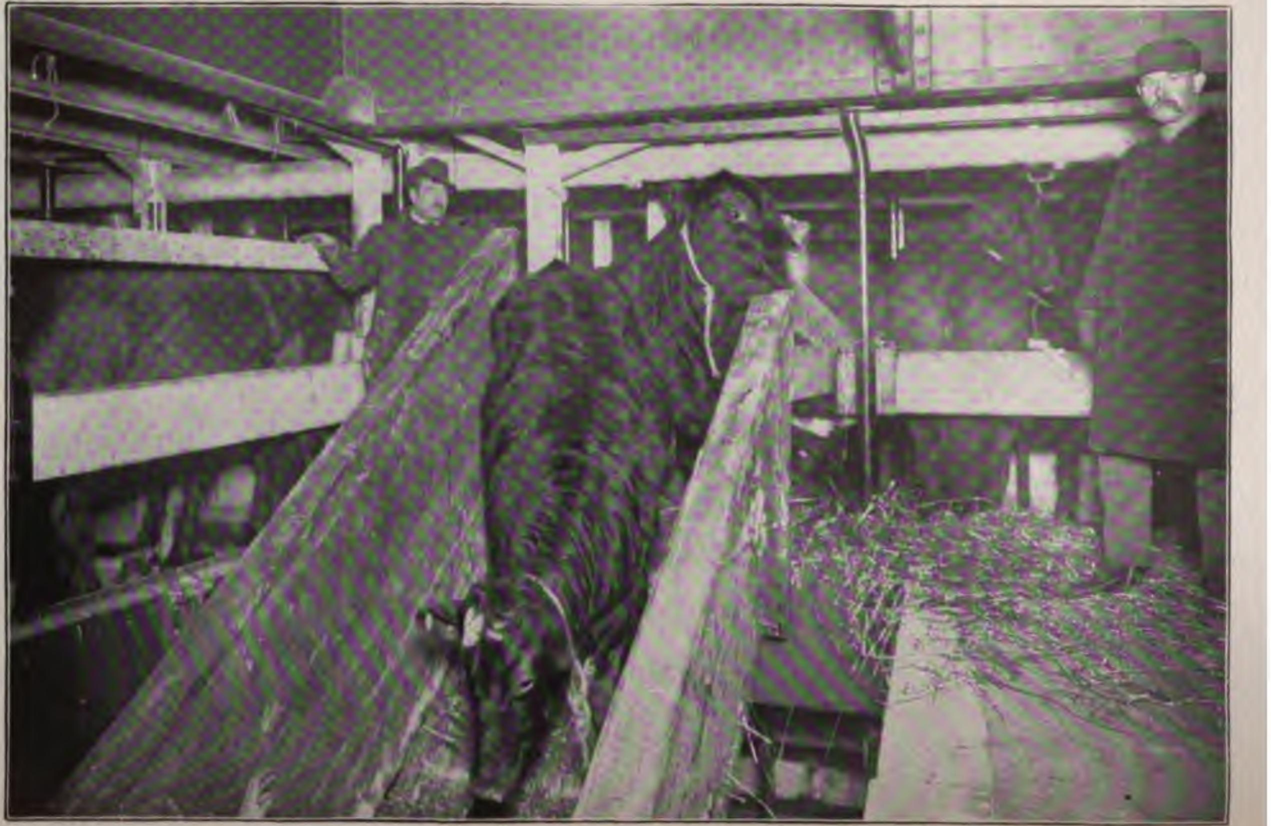
"The horses like to be talked to when there's a big sea on and things are pretty lively. They always like certain men better than others. So do the cattle. We have one man who can do anything with them. Every bullock and horse on the boat knows him by the time we've been out two days. He comes in handy when there's an accident.

"It's mighty seldom that a serious accident happens nowadays, but once in a while a horse or bullock does get thrown and breaks a leg or does some bad damage. We don't carry a veterinarian. The men know as much about ordinary cattle and horse ailments as any 'vet', and if one of the brutes breaks his leg there's nothing for it but to kill him. A veterinarian couldn't do anything for him.

"The company charges from $6 to $20 a head for carrying cattle and from $27 to $250 a head for horses. When the Government inspectors were put to work and stopped overcrowding, they cut down the carrying capacity of some boats 75 head. That made a pretty big hole in the ship's profits in the course of a year. Then, of course, the cost per head to the company is more than it used to be, because so much extra work has to be done. I guess they are making expenses all the same. They aren't in business for their health nor to accommodate the Government."



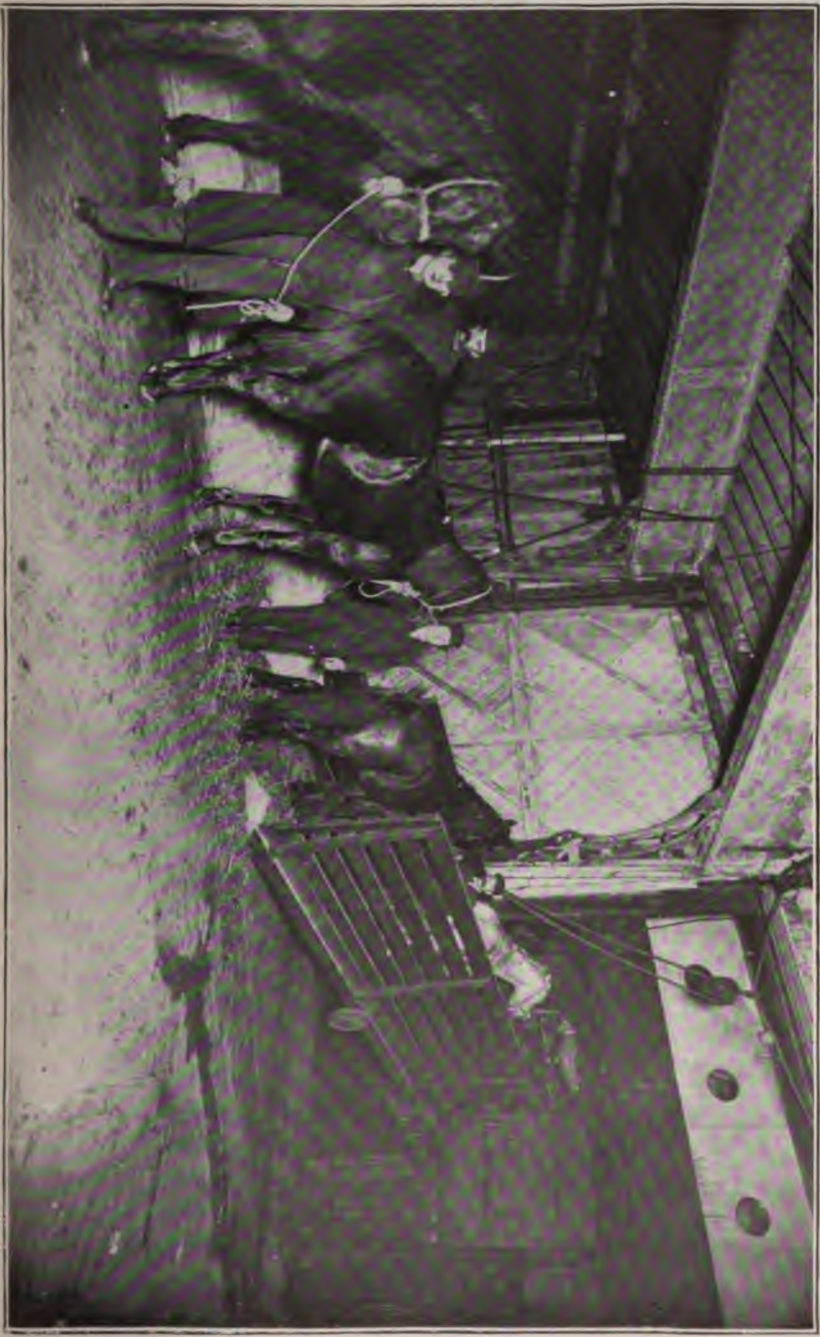
OCEAN TRANSPORT.—LOADING CATTLE FOR SHIPMENT.



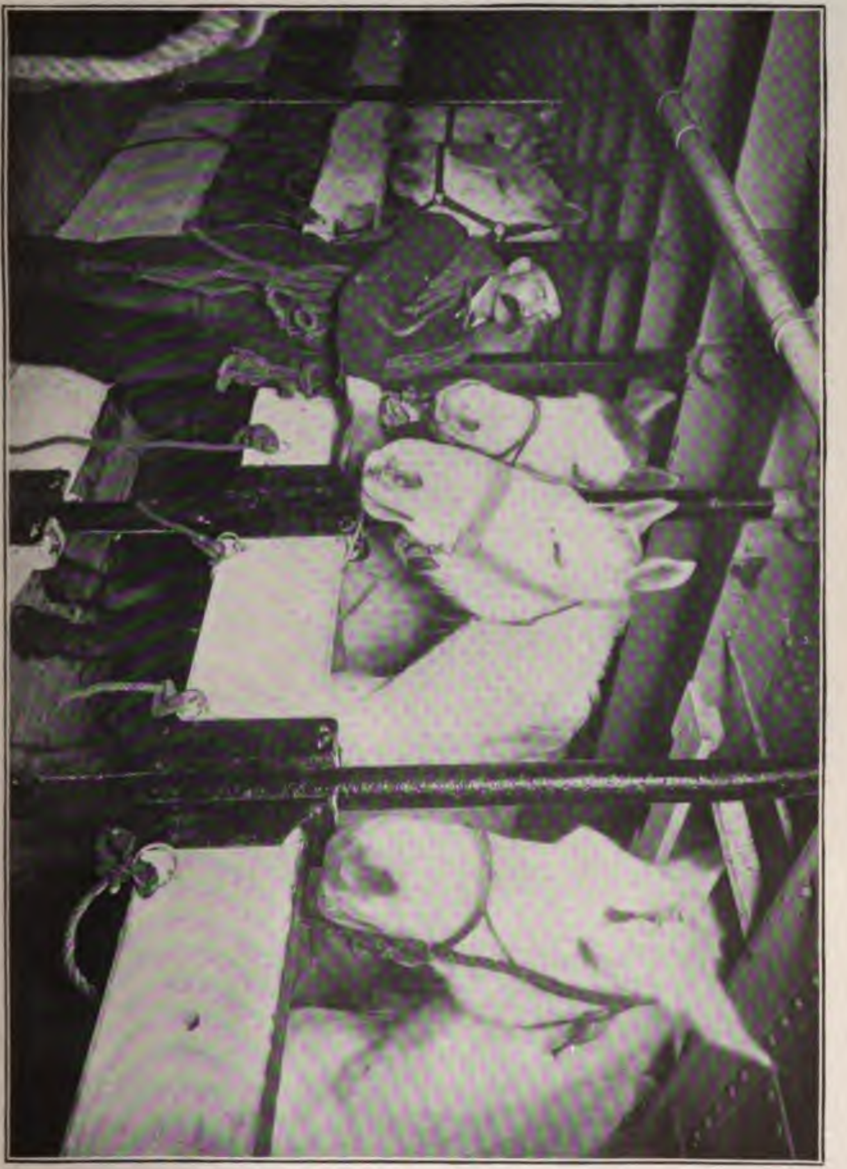
Ocean Transport.—Loading Cattle for Shipment.

Plate XVI.

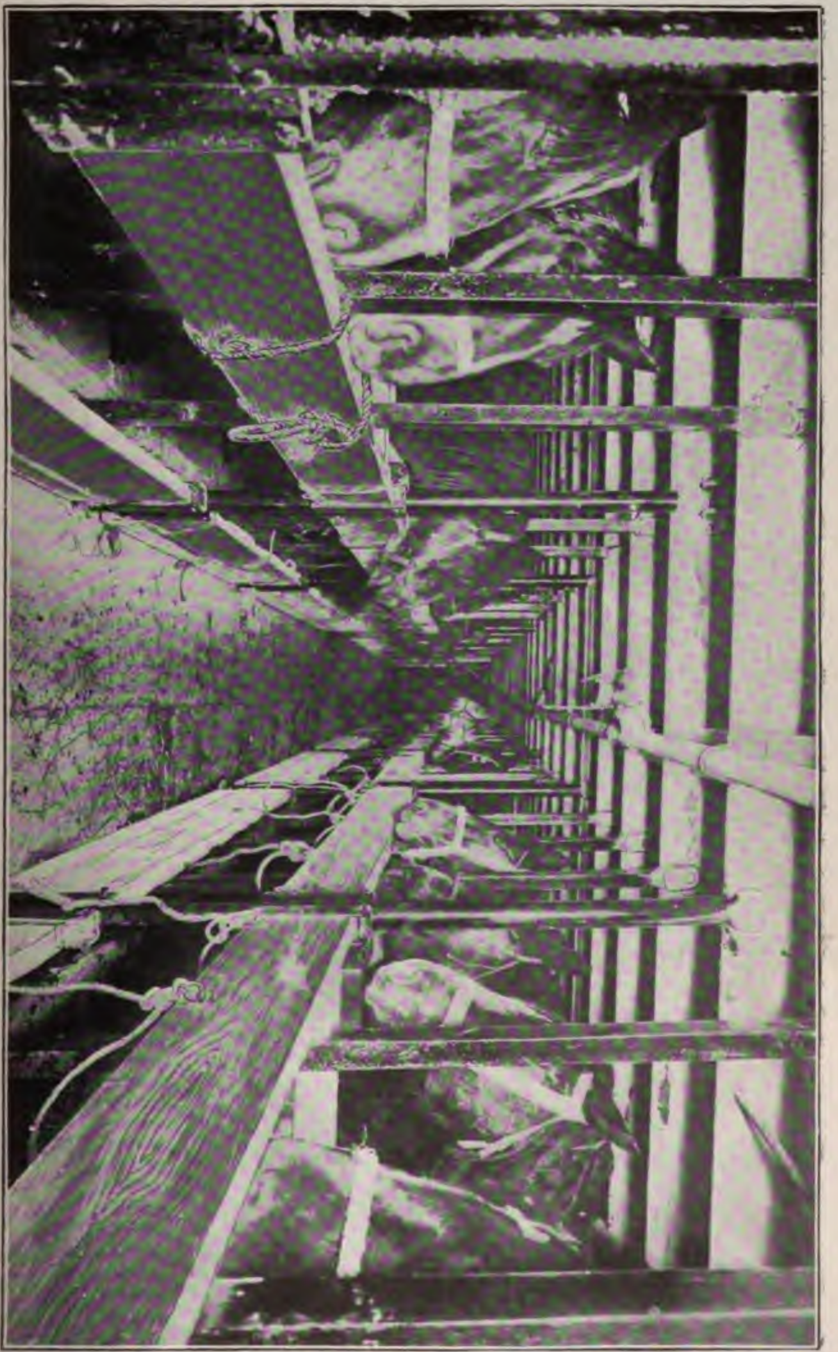
Ocean Transport.—Loading Horses for Shipment.



Ocean Transport.—Loading Horses for Shipment.



OCEAN TRANSPORT.—HORSES IN PLACE READY FOR SHIPMENT.



OCEAN TRANSPORT.—SHOWING METHOD OF TYING HORSES FOR SHIPMENT.

PLANT POISONING OF STOCK IN MONTANA.

By E. V. Wilcox, Ph. D.,
Office of Experiment Stations.

PRELIMINARY STATEMENT.

More or less serious losses of stock from eating poisonous plants occur annually throughout the United States. On large stock ranges, where stock are allowed to range at will and feed upon such native plants as they may find, cases of poisoning are more numerous and more extensive. The writer devoted considerable time to the problem of plant poisoning in Montana during a three years' residence in that State, and spent three months of the season of 1900 investigating the same subject, in connection with Mr. V. K. Chesnut of this Department.

During the season of 1900, the writer visited every county, in order to study the conditions under which poisoning occurred and to investigate so far as possible all cases of poisoning which occurred during the season. This field work included over 7,000 miles of travel within the State, during which a majority of the larger sheep and cattle ranges were visited. The stockmen of the State showed themselves to be much interested in the prosecution of this work, and assisted in all possible ways by furnishing means of transportation to points far distant from railroads and stage lines. Especial thanks are due to Hon. T. C. Power, Dr. M. E. Knowles, S. M. Emery, W. W. Beasley, G. M. Beasley, A. W. Bower, F. I. Bower, Frank Conely, Walter Cooper, Daniel Floweree, W. C. Gillette, Dr. H. Holloway, S. S. Hobson, J. B. Long, M. M. Jensen, J. L. B. Mayer, J. T. Murphy, I. D. O'Donnell, McC. Winiger, James Vestal, and J. P. Woolman.

The stockmen of the State gave prompt notification in cases of poisoning which occurred during the season, and many unusually good opportunities were therefore had for studying plant poisoning of stock in the field.

Losses from poisonous plants are more extensive in the case of sheep than in the case of other stock, and the greater part of this account will be occupied with descriptions of the conditions which lead to such poisoning, the plants concerned, and the methods for preventing serious losses. Sheep raisers, as a rule, are so situated that a part of their grazing range lies on level plains, while another portion extends over foothills and mountains. It should be remembered that many of them control large tracts of country, and that, therefore, large portions of their ranges lie at a considerable distance from the home ranch. The sheep are managed in the way in which they will be able to find the best grazing conditions during the greater part of the year. Most sheep men put up a quantity of hay for the winter, but in ordinary seasons it is expected that the sheep will obtain their sustenance during nearly all the year from the native plants growing upon the ranges. In general, the different bands of sheep, especially the ewe bands, are kept near the home ranch during the winter season and until after the lambing and shearing seasons are past in the early summer—that is, until about the 10th of July. They are then driven away to the summer range, which may be on level plains, but usually lies on the foothills or mountains.

Sheep raisers have long understood the dangers from poisonous plants in the early spring on mountain ranges, and have also understood that it is comparatively safe to allow sheep to graze in such situations from July until October. In connection with this annual change of grazing ground, it is of interest to note that the feeding habits of sheep differ considerably under the different conditions. On the plains sheep eat preferably the short fine grass and avoid weeds, while on the mountain ranges they feed to a great extent upon the native plants other than grasses which grow in such situations. It is a fact, generally observed, that sheep do not take kindly to the tall mature grass which is found on mountain ranges in the month of July. The plants on mountain ranges, which furnish a great part of the forage for sheep, include five-finger, spiræa, golden-rod, wild sunflower, sand vetches, wild licorice, wild geranium, and lupines.

A number of the native plants which are known to be poisonous are so far advanced by the time the sheep are taken to the summer range that they are too coarse and unpalatable to be eaten by sheep. This is especially true of the purple larkspur and death camas, the latter being quite dry and shriveled by the middle of June. The water hemlock is not so common in the mountains as along the small streams of the plains, and in its mature stages is so coarse that it is seldom eaten by sheep. The tall larkspur does not ordinarily grow on the plains, and is too coarse for sheep forage during the season from July to September.

With regard to the mountain ranges of the State, especial mention should be made of the native species of lupines. These plants are apparently poisonous only when containing ripe seeds, and it was observed that sheep seldom eat this plant on the range during midsummer. After the fall frosts the lupine pods open and the seeds fall out. In this condition it is often eaten in great quantities by sheep, especially after snowstorms, when other forage is covered up.

Cattle and horses are usually allowed to graze at will upon the range, and the distinction between the summer and winter range is therefore not so important as in the case of sheep.

The effect of alkali upon stock and its possible action predisposing them toward eating poisonous plants is much discussed by stockmen, but not well understood. The belief is gradually gaining ground that sheep are kept in better condition by regular salting, and are less apt to develop a perverted appetite than when left without salt and allowed to seek for alkali as the only possible substitute. The most common forms of alkali found in Montana are sulphate of soda and Epsom salts. It would seem impossible for these substances to take the place of common salt in the physiology of domesticated animals. It must still remain doubtful whether any serious cases of poisoning are to be attributed to the continued eating of alkali or drinking of alkaline water, but in a few instances direct evidence was obtained that the appetite of the sheep was perverted by the use of alkalis, and that more extensive poisoning occurred from eating poisonous plants than in the case of sheep that were regularly salted.

CONDITIONS WHICH FAVOR POISONING.

In discussing the conditions under which poisoning occurs, attention should also be called to the methods of managing sheep which are at present in vogue. The most serious cases of poisoning which the writer has observed have occurred while sheep were being driven from one point to another at a more rapid rate than would be assumed under normal feeding conditions. The practice of "trailing" sheep to market renders it necessary to urge sheep forward at a rate of from 6 to 10 miles per day. It is easy to understand that under such circumstances the sheep are forced to grab at any green thing within reach, and can not exercise the same choice of forage which they would if feeding at ease. The same conditions prevail in driving sheep from winter to summer range and often with disastrous consequences. An instance was observed during the season of 1900 in the case of a band of 2,000 ewes and lambs. This band of sheep had been grazing during the spring on a range where death camas was abundant, but no cases of poisoning had occurred until the band was moved. On May 24 the band was driven about 3 miles during the afternoon, and several of the sheep were observed eating death camas and other plants which grew in their course. As a consequence, about 20 ewes and 50 lambs were poisoned, of which 6 ewes and 10 lambs died. Many similar cases were observed, and they serve to call attention to the need of the exercise of greater care in driving sheep from one place to another.

An obvious method for avoiding the danger from driving or "trailing" sheep too rapidly consists in detailing two herders with each band, so that one may travel in advance of the sheep and direct the band away from the poisonous areas. The herder in the rear of the band may cooperate with the herder ahead in preventing the sheep from becoming too closely crowded together.

The present practice of the sheep raisers on Western ranges is to keep sheep under the constant care of a herder, in bands of from 2,000 to 2,500. They understand the great differences in the skill with which bands of sheep are managed by different herders. If a band is frequently "dogged" and urged forward, the inevitable result is to crowd the sheep together and render it impossible for those which happen to be in the center of the band to feed. It is impossible to insist too strongly upon the desirability of interfering as little as possible with the sheep during feeding. All sheep raisers understand that it requires considerable time for a large band to become scattered out after having been rounded up by dogs or by their fright. The time necessary for such redistribution of the band is lost from the feeding time and the sheep become hungry and excited. Under such circumstances it is frequently observed that they are more apt to eat unwholesome plants than when given greater liberty in feeding.

The problem of stock losses from poisonous plants is affected also by the water supply on the range. On ranges where the only water supply in the dry season is found in alkaline lakes, it would seem desirable to build troughs into which spring water is piped. This would enable stock to obtain water more conveniently, and the water would be less alkaline than when allowed to flow into alkaline lakes and gradually become saturated with alkali by evaporation.

It has long been observed that poisoning is especially apt to occur after heavy rains. A number of explanations for this fact have been offered. It has been supposed that certain plants are more poisonous when wet with fresh rains or dew than when dry. The explanation which is most frequently suggested, however, is that after heavy rainstorms the roots of various plants are more easily pulled up than when dry, and it is well known that in the case of many poisonous plants the active principle is chiefly located in the roots. In the case of death camas, the writer attempted to determine the question whether the bulb could ever be pulled up by the stem, and found that under ordinary circumstances this could not be done. After an unusually heavy rainstorm, however, it was found that a considerable proportion of the bulbs could be drawn out of the soil by pulling upon the stem of the plant. This observation is of some importance in connection with the fact that the bulb of death camas is considerably more poisonous than the leaves or stem. Similar statements might be made concerning the larkspurs, loco weeds, and water hemlock. As sheep pull up the bulbs and eat them while grazing after a storm, increased mortality from poison plants results.

A number of serious cases of stock poisoning have occurred after snowstorms. In all cases which were investigated an explanation was found in the fact that other forms of vegetation were covered by the snow and that certain poisonous plants of coarse growth remained standing above the snow. In some of the mountainous basins the tall larkspur grows abundantly and stands at a height of about 2 feet by the 1st of June, when late spring snowstorms are apt to occur. Frequent cases of poisoning in cattle, from eating large quantities of the tall larkspur, have been observed under such conditions. It may be doubted whether this plant would be extensively eaten under any other conditions. An occasion was offered to investigate some extensive cases of poisoning in sheep during autumn, for which lupine was responsible. In these cases the conditions were the same as in that just discussed. Early fall snowstorms had covered other vegetation, and large quantities of the lupines were still standing. Ordinarily the lupines are not poisonous at this time of the year for the reason that the seeds have fallen off, but during some seasons the seeds are retained much longer than usual.

The feeding habits of sheep and other stock are greatly influenced by the full or empty condition of the stomach. It would seem desirable to adopt a general rule never to turn sheep in a starved or unusually hungry condition upon a range which is known to contain poisonous plants in abundance. It requires but a few moments' observation to satisfy one's self that a sheep does not exercise the same care in the choice of forage when very hungry that it does when feeding under ordinary circumstances. The disastrous consequences of neglecting this rule are most frequently experienced while sheep are being shipped long distances by railway. When the sheep are unloaded from the cars at intervals for feeding, they are ravenously hungry and usually unacquainted with the plants which grow at the place where they are unloaded. A number of very extensive cases of poisoning have been observed under such circumstances. In one case 1,900 sheep died from eating lupine in a ripe condition. The sheep came from another State and were unaccustomed to the character of the vegetation where they were feeding.

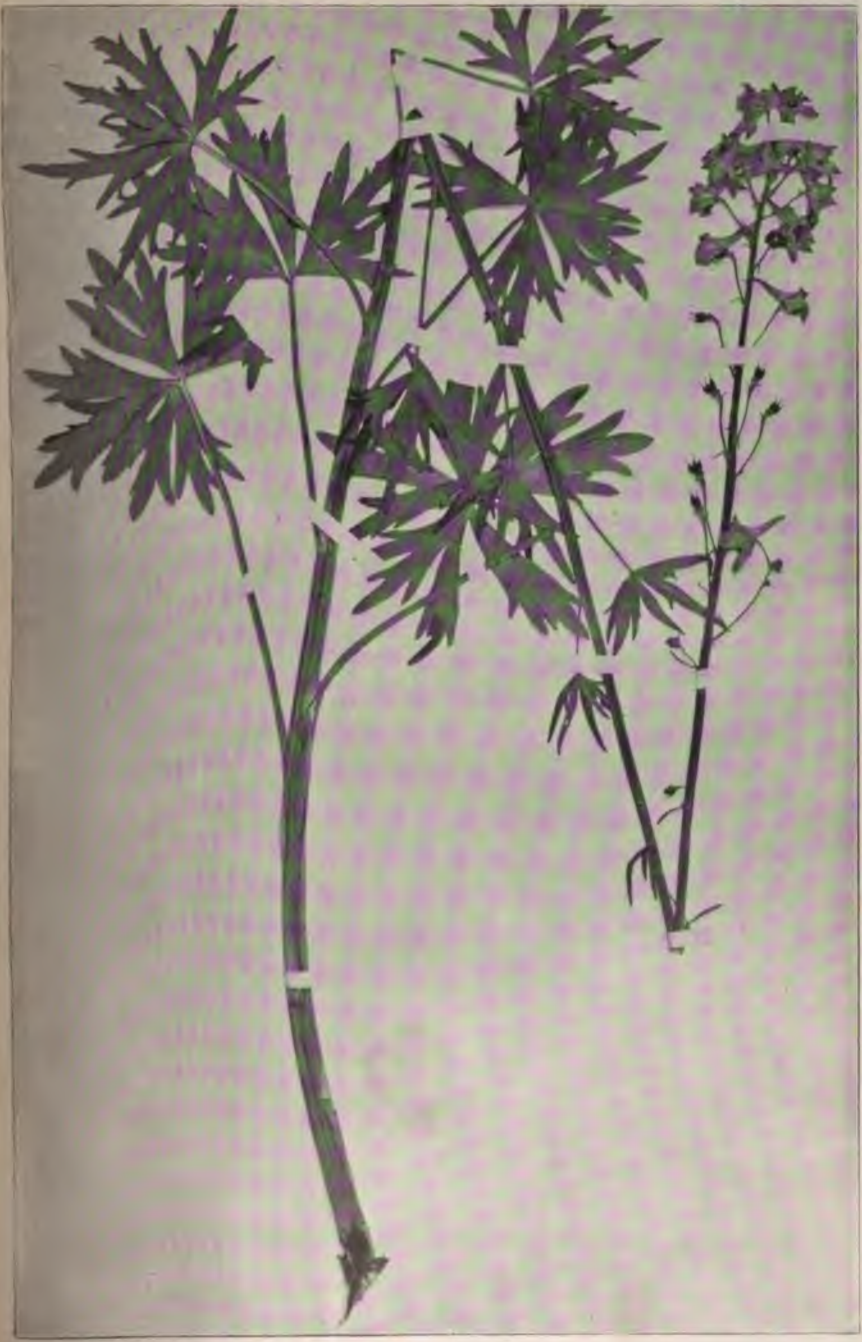
From observations made on the stock ranges of Montana, it is believed that it is impossible to conclude with certainty that sheep learn to avoid all poisonous plants by long acquaintance with a given range. In general, however, it may be said that on any particular range less extensive poisoning occurs among the sheep which are familiar with the range than among strange sheep. This statement may be accepted as true for all plants except loco. The eating of loco plants seems to be a pernicious habit, which spreads rather than decreases among the sheep which are acquainted with the range.

The actual condition of the vegetation in a given locality also exercises considerable influence upon the extent of poisoning which may occur. If certain poisonous plants start to grow in the early spring before the native grasses and offer a considerable amount of succulent material, sheep and other stock are naturally tempted to eat them, especially if it is difficult to obtain a sufficient quantity of grass. It sometimes happens that poisonous plants closely resemble grasses in general appearance. This is true of death camas before flowering, and since such plants grow mingled with grass it may be possible that they are unintentionally eaten along with the grass. During seasons of great drouth the native grasses mature earlier in the season than usual and soon become dry and unpalatable, while a number of other plants remain green and somewhat succulent for a longer period. This statement is especially true of certain leguminous plants, such as loco weeds and lupines. The loco habit is apt to become established in lambs during dry seasons. Lambs are more affected by drouth than the older sheep, and insist upon having some succulent forage. During dry seasons they may be able to find such forage only in loco weeds and other similar plants.

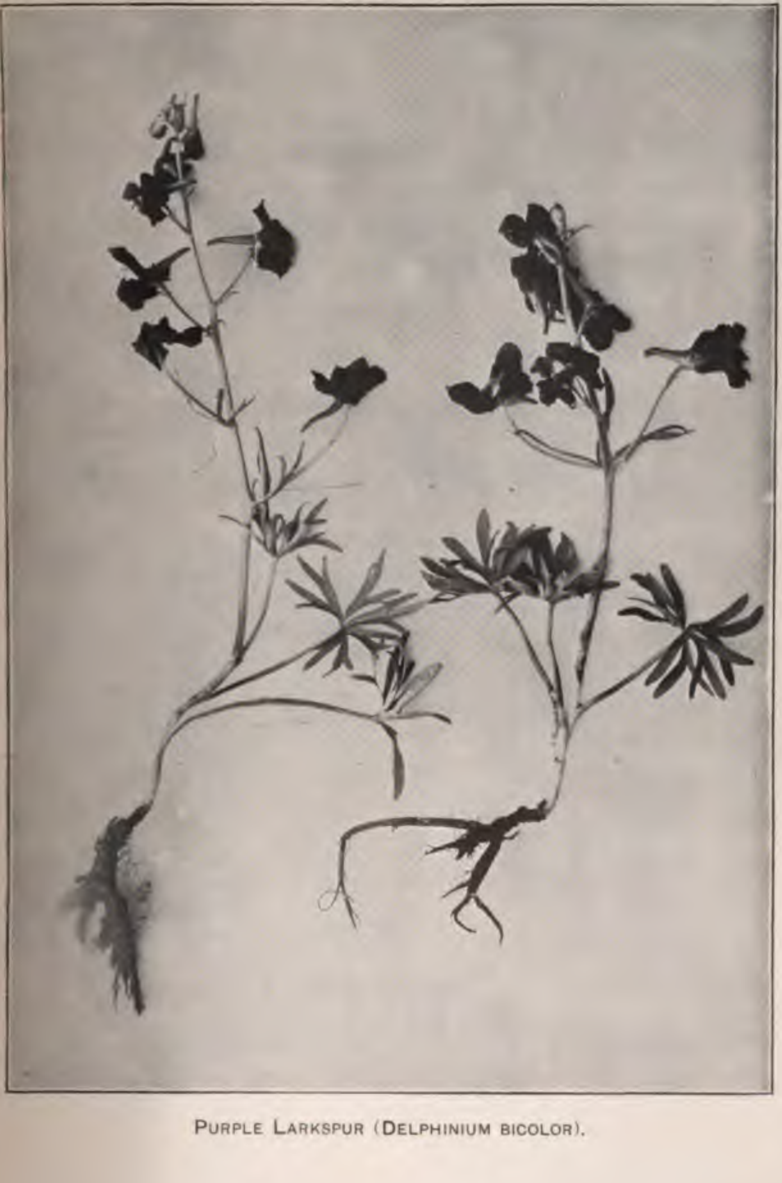
The stage of growth of the plant determines largely whether it will be eaten at a given time or not. For instance, larkspur and water hemlock become so coarse during their later stages that they are seldom, if ever, eaten by sheep; and some plants, as the death camas and purple larkspur, turn yellow and shrivel up very soon after flowering, and in such condition they are not tempting and are seldom eaten.

So far as it has been possible to determine by observation, the taste and smell of poisonous plants have little, if any, influence in determining the extent to which they are eaten. It must, of course, remain entirely doubtful whether plants which have an exceedingly disagreeable taste for us affect stock in the same manner. The taste of larkspurs is disagreeable and even nauseous to man, but they are frequently eaten in large quantities by sheep, cattle, and other animals. The death camas possesses a bitter principle and the juice produces an irritation of the mouth cavity, which persists for an hour or more and causes increased salivation. It was impossible, however, to get any evidence that the bitter taste had any influence upon the frequency with which the plant is eaten by the stock. From a theoretical standpoint it might be plausible that the taste and odor of plants largely determine their use as food by stock, and further observations on this point may lead to some definite conclusions in the matter.

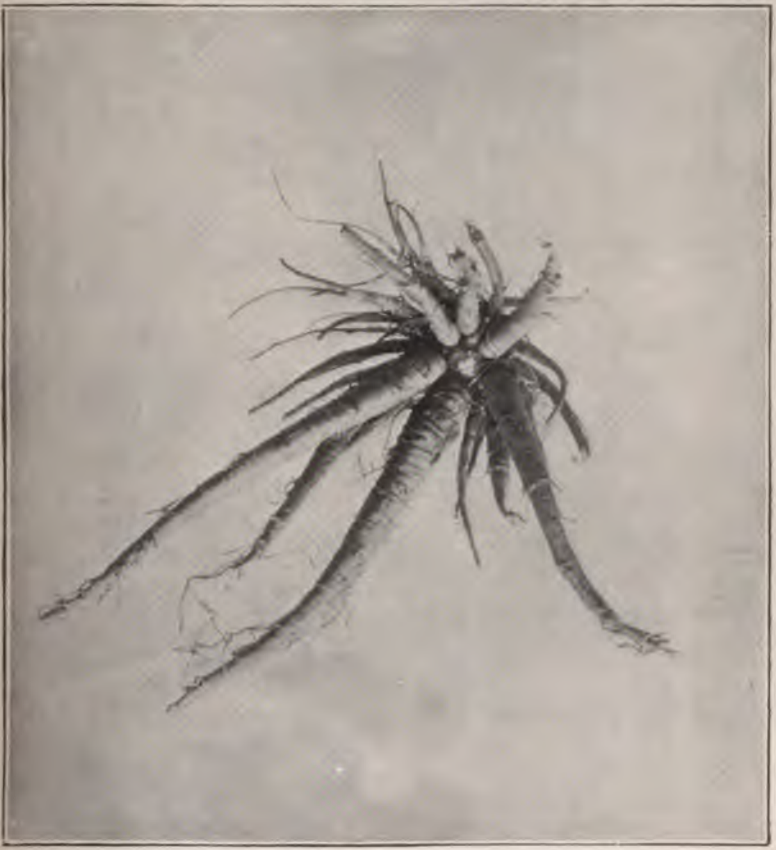
The problem just stated may be somewhat affected by observed variations in feeding habits of stock with reference to poisonous plants. It seems impossible to make any definite statements with regard to this matter, or even to predict from one year's observations what will be the feeding habits of sheep for another season. It is observed that during some seasons the purple larkspur is eaten in large quantities by sheep and other animals with serious consequences, while during other years the same sheep may walk over conspicuous areas of this plant without touching it. A striking variation is also observed in the feeding habits of a single band of sheep. One sheep may feed almost exclusively upon a certain plant which is scrupulously avoided by the others. The habits of sheep vary not only individually, but in the same band as a whole from season to season, and an equally



TALL LARKSPUR (DELPHINIUM GLAUCUM).



Purple Larkspur (Delphinium bicolor).



WESTERN WATER HEMLOCK (CICUTA OCCIDENTALIS).

striking variation is noted in the different parts of the State and in different States. An illustration of this variation may be of interest in this connection. The feeding habits of a band of sheep on a foothill range, at an altitude of 4,600 feet, were observed. Some of the sheep ate considerable quantities of wild sunflower, a few ate false lupine, some fed largely upon the wild geranium, while others grazed almost exclusively upon sand vetches. Two were seen eating the leaves of lupine, and about 50 ate a few specimens of death camas. The majority of the sheep in this band fed exclusively upon the native grasses. On one range a band of sheep was kept for two months during the spring of 1900 on a range which abounded in death camas without any cases of poisoning occurring. Another band on the same range passed over a conspicuous area of purple larkspur twice daily in going from and coming to the corral, and no evidence was to be obtained that they had touched this plant. The same band, however, on being moved to a locality where they found the death camas, became poisoned, and a number of them died. Nearly all of the band had been affected, showing that the plant was generally and greedily eaten. The arbitrariness of the appetite of sheep exercises a great influence on the occurrence and extent of poisoning. Obviously, poisonous plants do no harm until eaten, and the chief factor in determining the amount of poisoning which is likely to occur on a given range is the extent to which the plant will be eaten by the sheep. This factor can not be estimated with any certainty. It can not be determined by feeding experiments, since it is impossible to reproduce the natural conditions which prevail upon the range. It is manifestly unsafe to assume that an animal is fond of a certain plant because it is eaten in confinement when no other fodder is to be had.

The actual extent of stock poisoning can not be learned with certainty, for the reason that a considerable proportion of cases are never reported, even in the local newspapers. During the season of 1900 the writer had opportunity to observe a large number of cases of poisoning, of which the majority are included in the following statement:

Number of animals poisoned by plants in Montana in 1900.

Poisonous plants.	Sheep.		Cattle.		Horses.	
	Poisoned.	Died.	Poisoned.	Died.	Poisoned.	Died.
Death camas	3,030	636				
Swamp camas	40	15	6	2		
Lupine	7,700	3,712			4	3
Purple larkspur			2	2		
Tall larkspur			100	56		
Water hemlock	105	80	36	30		
Loco	3,550	700	3		150	3
Total	14,425	5,143	147	90	154	6

REMEDIAL AND PREVENTIVE MEASURES.

A number of remedial and preventive measures may be suggested from observation and experience. Experiments have been tried on a small scale in various parts of the State in displacing poisonous plants upon the range by the use of aggressive forage plants, such as smooth brome grass and blue joint (*Agropyrum occidentale*). These grasses grow vigorously upon the ranges of the plains and mountains. Naturally the brome grass attains a much greater size and covers the ground more completely in moist than in dry situations. Judging from the present outlook in Montana, it will require several years for the brome grass to form a sod sufficiently thick to displace death camas, larkspur, or loco weeds. The brome grass starts early in the spring and is much sought for by sheep. A native species of brome grass (*Bromus marginatus*) is rapidly spreading in some parts of the State, especially near Augusta and in the Judith Basin, and in the former locality has killed out a few timothy meadows and entirely replaced the timothy. Although it can not be said that experiments have so far demonstrated the possibility of driving out poisonous plants by this method, the habit of starting early in the spring, which is characteristic of brome grass, is very useful, since desirable forage is thus afforded for the sheep at the season when poisonous plants are most often eaten.

It is highly desirable that herders should familiarize themselves with the appearance of the more important poisonous plants in all their stages. They will thus be enabled to recognize such plants at once, and to herd sheep and other stock away from the dangerous areas. A herder who is familiar with the appearance of poisonous plants should be more valuable to the sheep raiser, for the reason that he will be in a position to avoid many serious losses. The number of plants which are of great economic importance from their poisonous principles is not large, and many of them are already thoroughly known by the average herder. In some cases, however, great confusion prevails as to the names of plants, and this confusion can only be avoided by careful study of the characters of the plants. It would seem almost inexcusable to confound death camas and the wild onion, yet such has been the case for a number of years over a large portion of the State. In some localities lupines are known as loco weeds or larkspurs indifferently, and vice versa.

On some portions of the range where death camas grows very abundantly it will probably be found necessary to abandon certain areas during the spring months. Later in the season, as already indicated, the death camas dries up and offers no tempting forage to stock.

The possibility of eradicating a poisonous plant by digging manifestly depends almost entirely upon the extent of its distribution. In the case of the tall larkspur, which usually occurs in well-defined areas, the plant might be dug up at a moderate expenditure. The water hemlock also occurs in well-defined localities along streams and irrigation ditches, and might be exterminated in the same manner. Such plants as the loco weeds, death camas, and purple larkspur, however, grow in too great a variety of situations and in too great quantity to be exterminated in this manner. Even cultivation of such areas can not be recommended, since ordinarily difficulty would be experienced in getting water upon the land in sufficient quantity to irrigate, and no cultivated crops could therefore be raised.

In the treatment of poisoned animals serious mistakes are often committed by herders and cowboys. It is frequently assumed that poisoned animals must be kept moving under all circumstances. This may possibly be beneficial in poisoning of a narcotic nature, where the animals become stupefied. In all cases, however, where unusual excitement is manifested, the animal should be left entirely to itself, without any additional cause of fright or excitement. The inevitable result of all unnecessary stimulation of animals which are poisoned upon the range is to exaggerate the effects of the poison and to hasten a fatal result. In general, therefore, it would seem advisable to allow animals to lie down or to move about at will, without any interference. The injurious effects of urging sheep forward, when suffering from larkspur poisoning, have already been described by the writer in Montana Experiment Station Bulletin No. 15. Sheep herders and cowboys have resorted at once to bleeding in all cases of poisoning of animals. Different places for bleeding, which are supposed to have more beneficial effects than any other are the root of the tail, the ear, the inside of the lips, or the roof of the mouth. Bleeding at one or the other of these places is claimed to be almost uniformly efficacious. With regard to this practice, it is obvious that it will have a good or bad effect according to the symptoms of the poisoned animals. If the poisonous plants which have been eaten have a depressant action upon the heart and circulation, the blood pressure would be further lowered by drawing blood, and the practice should not be indulged in. In a case of poisoning, where the chief symptoms are increased blood pressure, accompanied by cerebral excitement and a hard pulse, the bleeding might have a good effect.

Melted lard or fat pork is frequently administered in cases of plant poisoning, especially in "bloat." These substances have a laxative action which may help to eliminate the unabsorbed parts of the stomach contents. The lard may hinder the absorption of the poisonous substances by the formation of an oily coating on the wall of the stomach. Drenches of baking soda (bicarbonate of soda) are frequently given in cases of poisoning where an unusual amount of acid in the stomach is suspected. Soda often has a good effect in the case of bloat from eating large quantities of clover or alfalfa. Vinegar is another much used popular remedy for plant poisoning. It is administered when the stomach contents are believed to be strongly alkaline. One stockman stated that he had frequently administered both soda and vinegar at the same time with beneficial results. It would seem, however, that these substances would naturally neutralize one another in the stomach cavity.

During the season of 1900 the best success in the treatment of animals poisoned with noxious plants was obtained from the use of permanganate of potash. This substance is well known as an antiseptic in surgery, as well as for internal use. Its antiseptic action is due to its great oxidizing power. This substance was used in cases of poisoning for the purpose of destroying such portions of the poisonous alkaloids as still remained in the stomach. It was not supposed that permanganate of potash would exercise any noticeable effect as a physiological antidote of plant poisons; but it was believed, on the other hand, that the pronounced oxidizing power of potassium permanganate would destroy plant alkaloids which had not been absorbed from the stomach, and thus enable the animal to recover, provided a fatal dose of the poison had not already been absorbed. The permanganate of potash was administered in three different ways—as a drench, by allowing the animals to drink it, and as a direct injection through the walls of the stomach. No pronounced advantage was noted in favor of any method. The drenching would perhaps be preferred by stockmen generally as being more simple and convenient of application. The action of the potassium permanganate is perhaps a little more direct and prompt, if a solution is injected directly into the stomach by means of a syringe. This method, however, requires a little more time than drenching, and, although fairly safe in the hands of an intelligent stockman, is not so simple as drenching.

In all experiments a solution was used containing equal weights of potassium permanganate and sulphate of aluminum. The latter substance was added for the purpose of counteracting any alkaline reaction of the water which might be used in making the solution, and for increasing the oxidizing action of the potassium permanganate. From our experiments it seems desirable to recommend that from 5 to 10 grains of each of these compounds be dissolved in water together and given as a drench to adult sheep. A smaller quantity may be given to young lambs. Hogs will take the same dose as sheep, horses from 15 to 20 grains, and cattle from 30 to 50. In dissolving these substances a quantity of water should be taken, which is most convenient for drenching purposes, usually about a pint, but a quart or even more may be taken. In cases where a large number of animals are poisoned at once, it will be found desirable to prepare a large quantity of the solution, containing a thousand or more doses, dissolved in water in such proportions that a convenient quantity of the water, say

1 pint, will contain the desired amount of the potassium permanganate. This substance forms slightly explosive compounds when mixed with sirup or similar organic substances; otherwise no especial precaution is to be observed in its use. When administered to animals it should all be in solution, since the pure salt would irritate the mouth cavity. It will be found to dissolve much more rapidly and surely when pulverized before mixing with water.

The sheep is easily managed, and no method of administering remedies offers any noteworthy difficulties. Convenience and rapidity of application are the chief factors in determining what method shall be adopted. When a thousand or more sheep are poisoned simultaneously, no remedy is practicable which requires any great length of time for its application. Drenching is, perhaps, the most rapid method for this purpose, and long-necked bottles or regular drenching bottles may be used. In drenching, the sheep should be set upright, and care should be exercised that the solution is not wasted. With a little experience the drench may be given rapidly with no danger to the sheep. In cases of poisoning, where the throat is paralyzed and the animal unable to swallow, drenching will be found dangerous or impossible. In such cases the solution may be injected directly into the stomach by means of a large syringe and trochar and canula. The point for inserting the canula should be the same as that which is adopted for "paunching"[1] in cases of bloat.

BLOATING AND ITS REMEDY.

Stockmen are usually acquainted with the serious or fatal consequences of bloating in cattle and sheep. The plants which most frequently cause bloat are alfalfa and various clovers, but ordinarily only when eaten in a green condition. A few cases are reported, however, from eating alfalfa or clover hay. It is usually asserted by stockmen that the liability of bloating is greater when the alfalfa or clover is moist with rain or dew or after a slight frost. The danger of bloat is certainly much greater in animals which are unaccustomed to this kind of forage, and gradually disappears after feeding upon green alfalfa or clover for a long time. A number of cattle and sheep die every year from this trouble, which becomes quite serious at times. The remedies in most common use by sheep herders and cowboys for preventing the fatal effects of bloating are doses of lard and "paunching." The usual instrument for making the incision is a long knife with a blade an inch or more in width. The gases which are formed in the stomach are thus allowed to escape and the pressure upon the internal organs is relieved. Many stockmen prefer to use a trochar and canula, which are especially designed for such cases and are for sale by dealers in veterinary instruments. The chief advantage in this instrument is that it is much smaller than the knife and the incision heals more readily, without liability of complications. In incipient bloat the administration of large doses of soda in connection with cathartics may render this operation unnecessary. Where the stomach becomes so extended that the animal can not walk, it becomes necessary to puncture in order to prevent fatal consequences. The gas pressure within the first stomach may in some cases become so great as to interfere with respiration and the action of the heart, or even to rupture the stomach wall and diaphragm. The proper place for making the incision may be described as being the point upon the left side of the body equally distant from the last rib, the angle of the hip bone, and the border of the lumbar vertebræ. At this point the wall of the stomach and the body wall are in close proximity, which renders the operation simple and effective.

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[1] A common phrase among stockmen for rumenotomy; i. e., the operation of cutting into the first stomach.

MOST IMPORTANT POISONOUS PLANTS OF MONTANA.

Death camas (*Zygadenus venenosus*) (fig. 5).—This is a smooth, simple-stemmed perennial, with an onion-like bulb, narrow linear leaves, and a short terminal cluster of greenish yellow flowers. The plant abounds everywhere in Montana in moderately moist places in open ranges. It is frequently called in the State by the misleading name of "wild onion" (fig. 6).

The death camas is undoubtedly the most important poisonous plant in the early spring in Montana. It is found in every county of the State and on every stock range which the writer visited. It occurs in great abundance in the localities where it is found, and starts growing very early in the spring, even somewhat in advance of the native grasses. The leaves of the plant are narrow and resemble grass leaves, being at the same time somewhat thicker and more succulent than grass. These facts combine to make the death camas a dangerous enemy to stock. The preferred location in which this plant grows is the low, shallow coulee, or ravine. It does not grow in the driest situations on the level plain nor in swampy localities. In Montana, it grows at altitudes varying from 1,900 to 8,000 feet, or in all altitudes at which sheep are grazed. A sheep may, in the course of a short time, eat a sufficient number of death camas plants to cause death. In collecting the material for feeding experiments, the writer dug up 250 death camas plants in the course of a half hour, and it may be possible for a sheep to collect them even more rapidly where the plant grows abundantly. It is impossible to state definitely whether the aerial parts of the plant or the bulbs cause the most poisoning. Feeding experiments showed conclusively that both the leaves and the bulbs are poisonous, but the bulbs could not be obtained by sheep or other animals except after heavy rainstorms, when the ground was thoroughly softened. During the season of 1900, sheep died from eating this plant at various dates in the months of May and June. The earliest date at which sheep were poisoned by this plant was April 25.

From notes made in the field it appears that 636 sheep died during the present season from eating death camas, while the total number poisoned by this plant was 3,030. This gives a death rate of 21 per cent. The death rate, however, may be somewhat higher or lower than this figure, since the figures as given are based on the adult sheep, and do not include fatalities among lambs. A great variation in the death rate was observed in different bands of sheep, and depended apparently upon the amount of poison which they had received. The death rate varied from 5 to 48 per cent in different bands.

On May 21 the writer secured two healthy sheep in a corral and fed them 30 plants of death camas without the bulb and 20 with the bulb, respectively. After one hour symptoms of poisoning began to be manifested, which were identical with those previously observed in the field as due to eating death camas under natural conditions. Both these sheep were seriously poisoned and required three days for a complete recovery from the effect of the poison. On June 8, two other sheep were fed each 40 death camas plants with the bulbs. The same symptoms were manifested in a violent

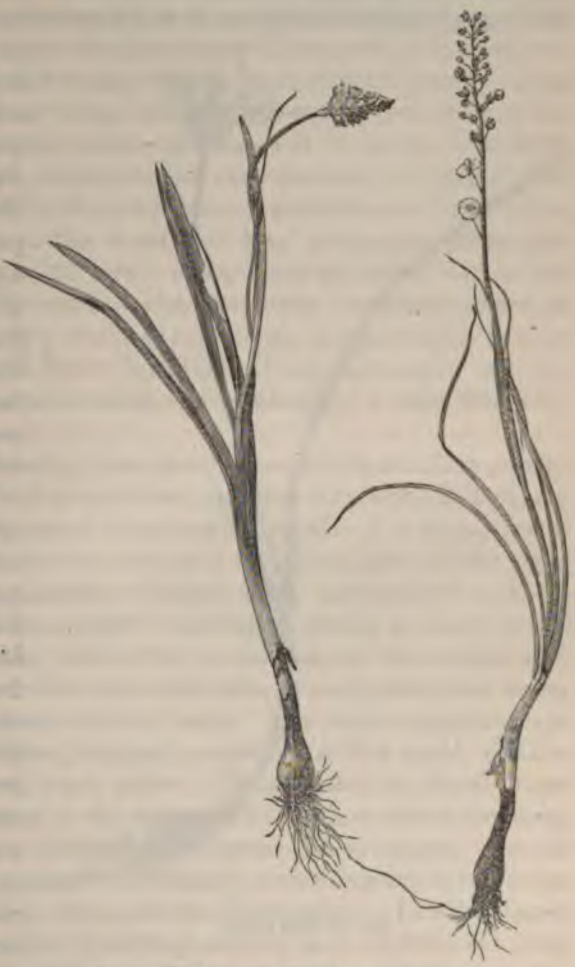


FIG. 5.—Death camas (*Zygadenus venenosus*).

form, and both sheep died after five and six hours, respectively. The plants which were used in these feeding experiments were in full flower. From these experiments it would appear that the fatal dose of death camas for sheep is between one-half and 1 pound.

The remedies which were tried in the cases of death camas poisoning included hypodermic injections of strychnine in one-twentieth, one-tenth, and one-fifth grain doses, hypodermic injections of atropine in one-sixtieth and one-thirtieth grain doses, and solutions of potassium permanganate made as previously described. The potassium permanganate was given in 4-grain doses as a drench and by means of direct injection through the body wall into the stomach. In a few cases the sheep were allowed to drink the solution.

The first experiments with these remedies were made on May 15, 1900, on a range near Great Falls. A number of sheep had been poisoned with death camas two days previously. A number of the most severe cases had been separated in a covered shed. The sheep were lying upon the side in a condition of complete paralysis characteristic of the last stages of poisoning by this plant. Five of them were given hypodermic injections of strychnine, 5 others similar injections of atropine, another 5 solutions of potassium permanganate, and the remaining 5 were left without treatment. All these sheep were examined three hours later, when it was found that those which had received potassium permanganate were in a much-improved condition and able to walk. The breathing was much improved and regurgitation through the mouth and nostrils had ceased. The sheep which were treated with strychnine were slightly improved. They could not stand, however, even

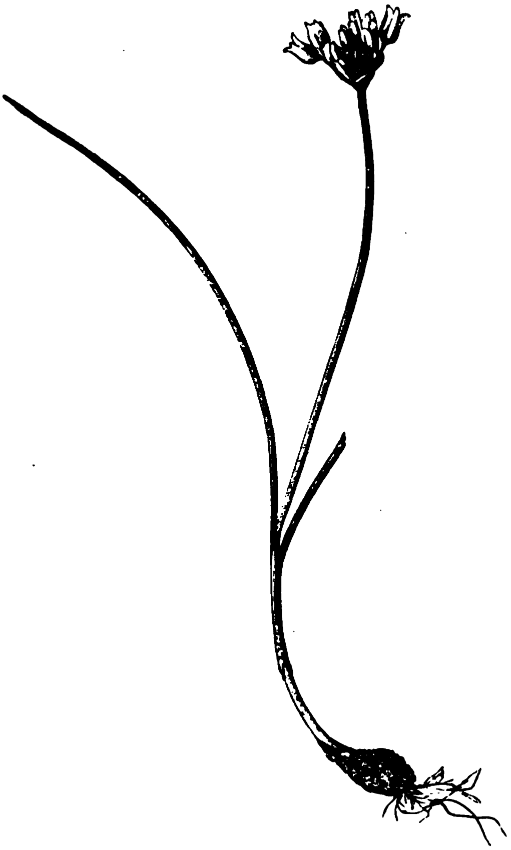


FIG. 6.—Wild onion.

when placed in that position. Of the sheep which were treated with atropine, 2 had died and the other 3 were not improved in their condition. All of the untreated sheep, all those which were treated with atropine, and all but 1 of those which were treated with strychnine died, while the 5 sheep which received the potassium permanganate made a complete recovery. These results indicate a very beneficial action of potassium permanganate in cases of poisoning from death camas. It appears also that the physiological action of potassium permanganate is to some extent antagonistic to that of death camas. Evidently its chemical action brings about a prompt destruction of the poisonous principles of this plant; otherwise it would be impossible to account for the rapid improvement and recovery of sheep after having exhibited unmistakable symptoms of fatal doses of the plant.

At subsequent dates in the month of May potassium permanganate was administered to 15 adult sheep and 20 lambs which had been poisoned by death camas, with decidedly beneficial effect in all cases. Lambs from two weeks to one month old, and which had not eaten any grass, received direct injections of this substance into the stomach without any harmful results and with signs of relief from the effect of the death camas.

The symptoms of poisoning from death camas as observed in a large number of cases were rather uniform, and the following description should enable any sheep raiser to recognize them. A certain uneasiness and irregularity in the movements of the sheep are the first signs of poison. These irregularities become more pronounced and are accompanied by spasms and rapid breathing. Sheep become excited under the influence of the poison, but do not exhibit the condition of frenzy. It was observed that ewes were able to recognize their lambs until within a few minutes before death. The later symptoms are those of complete muscular paralysis, combined with a rapid, shallow breathing and a frequent, weak pulse. The duration of the different symptoms varies according to the amount of the plant which the sheep has eaten. When large quantities are eaten the symptoms succeed one another rapidly, the spasms and labored breathing are very noticeable, and death results in from one to three hours. In other cases like those already described the sheep remain in a condition of complete paralysis for a period of twenty-four to forty-eight hours. In such cases the breathing was so shallow as to be scarcely perceivable. A small percentage of sheep recover after being in this condition for a few hours, but very few ever recover after being paralyzed for twenty-four hours. Postmortem examinations made on 40 sheep which had died from eating death camas showed the lungs in all instances to be filled with blood. There were no changes in the brain and no marked congestion, except in a few cases of long duration. In adult sheep the effect upon the digestive organs was not marked.

There was also an increased amount of saliva and regurgitation through the mouth and nostrils. In lambs these symptoms were present with the addition of pronounced digestive disturbances.

A majority of sheep which were poisoned from death camas, as is the case with other poisonous plants, were yearlings and 2-year-olds. It is possible that more fixed and settled habits of feeding are formed as the animals grow older. There was no indication that ewes with lambs at their side were any more apt to eat death camas than were dry sheep.

It is frequently observed in the study of stock poisoning that a great variation prevails in the time when the first symptoms of poisoning develop. The only explanation for this fact which suggests itself is to be found in the anatomy of ruminants. In one case it may happen that the poisonous substances pass into the fourth stomach and are thus absorbed at once, while in another case poisonous plants may remain in the first stomach, or rumen, with a mass of other forage material and are not absorbed until after some hours. Obviously, a poisonous plant has no effect upon domestic animals until absorption takes place, and the variation of time at which the symptoms are manifested may perhaps be explained by the facts to which attention has just been called.

The evidence establishing the poisonous nature of death camas from observation and with experiments is quite conclusive. Death camas was found to be present in abundance in localities where poisoning occurred. It was found upon examination of the range that this plant had been eaten extensively. Death camas was found in large quantities in the stomachs of sheep which died under such circumstances. Sheep which were seen eating the plant when feeding at leisure upon the range showed within a few hours the symptoms of poisoning as previously described. Besides this evidence obtained under natural conditions, experimental proof was secured by collecting death camas and feeding it to sheep. During extended trips over different parts of the State many localities were examined where it was stated that poisoning uniformly occurred if sheep were allowed to range there during the early spring. Death camas was found to be the only suspected plant which grew in abundance in all such localities.

TALL LARKSPUR (*Delphinium glaucum*) (Pl. XX).—This is the common tall larkspur of Montana, often erroneously called aconite. It is a simple-stemmed perennial, 3 to 6 feet in height, smooth throughout, and covered during its earlier stages with a whitish coating. The basal leaves are long stemmed and form tufts which attain the height of a foot or more by the 1st of June. These lower leaves resemble those of the wild geranium, being circular in outline and divided into a number of broad segments. The upper-stem leaves become gradually narrower with narrowing lance-like segments. The flowers are numerous, pale blue, and in a long terminal raceme. The tall larkspur is most likely to be mistaken for the wild geranium during its younger stages before flowering. After flowering the two species are readily distinguished. A little experience, however, during which special attention is devoted to the leaf characters of the two plants, will enable anyone to note the differences, even at a considerable distance. The leaves of the geranium are always somewhat hairy, while those of the larkspur are smooth.

The preferred habitat of the tall larkspur is in moderately moist shaded localities, especially on foothills and along the mountain sides. It occurs in valleys and up to an altitude of 9,000 feet. At the higher altitudes flowers are often darker blue in color and the height of the plant is somewhat less.

Attention has already been called to the possibility of eradicating poisonous plants by digging. This method is especially applicable to the tall larkspur. To illustrate this point, it may be well to describe briefly the conditions in the lower Gallatin Basin, where cattle have been allowed to graze every season for a number of years. A few animals are poisoned every year by eating the tall larkspur. In 1898 the loss amounted to 40 cattle, while ordinarily the losses are much smaller. In this basin the larkspur is almost entirely confined to a few areas of small size. It is believed that a month's work for one man with a weed digger, designed for cutting off the roots at a short distance below the ground, would exterminate the plant. The expense of this labor would not exceed the value of two cattle, and this number is less than the average annual loss from the tall larkspur on this range. Similar conditions were noted in the vicinity of Deerlodge, Red Lodge, and Bigtimber.

All cases of poisoning from this plant observed in Montana during the season of 1900, as well as in previous years, have been among cattle. Apparently it is not eaten by sheep, partly for the reason that the plant is too coarse by the time the sheep are driven to the summer range. Stockmen occasionally claim that horses and cattle may eat the plant in considerable quantities with impunity, and the observations already made on the tall larkspur indicate a considerable variation in its poisonous properties at different stages of growth. Apparently the plant is uniformly dangerous or fatal when eaten in large quantities in its earlier stages and up to the time of flowering. The root system of the tall larkspur is extensive and the roots are probably never eaten by stock.

The only remedy with which experiments have been made by the writer in treating stock poisoned by this plant is potassium permanganate as a drench. This substance, combined with sulphate of aluminum, was given in doses of 25 grains to 4 cattle, and all of these animals recovered. The remedy was given during the first stages of poisoning and before it was possible to determine whether or not the cattle had eaten a fatal quantity of the larkspur. However, 3 of the cattle, which were poisoned at the same time and were not treated, died within about six hours after the first appearance of the symptoms.

The symptoms of poisoning by this plant generally are the same as from an overdose of aconite. There is a more or less pronounced stiffness, accompanied by straddling and irregularity in gait. These symptoms increase in severity until locomotion becomes impossible and the animal falls to the ground. If subsequently excited, the animals may suffer from severe muscular spasms. The special senses are seldom affected, and slightly increased salivation is noted in some cases, though the symptom is never so marked as in poisoning from death camas. The animal is finally attacked with violent convulsions, in which it dies. In this respect, also, the symptoms differ from those of death camas poisoning, which latter are generally quite without spasms. The digestive functions are not noticeably affected by larkspur poisoning. The temperature may be slightly lowered at first, and during the later stages the pulse and breathing become rapid.

Observations thus far made indicate the advisability of administering potassium permanganate and sulphate of aluminum at once, as recommended for death camas poisoning. For counteracting the physiological effects of larkspur, atropine in hypodermic doses of one-half to 1 grain for cattle and horses will give good results. Alcohol and other stimulants may be administered.

The most effective preventive measure consists in determining the exact distribution of this plant upon the range and herding stock away from the dangerous areas during the spring and early summer.

PURPLE LARKSPUR (*Delphinium bicolor*) (Pl. XXI).—This plant is a slightly hairy, tuberous-rooted perennial, 1 to 2 feet in height, with a cluster of divided, long-stemmed root leaves, and dark purple flowers, which appear from May to August, according to the altitude. The purple larkspur is common throughout Montana on moderately moist foothills and mountain ranges at all elevations up to 10,500 feet. Its distribution is much more general and extensive than that of the tall larkspur. In the majority of localities where it grows, it would seem, therefore, impossible to exterminate it by digging or other practicable methods. The purple larkspur often occurs abundantly together with death camas, and its habitat in general seems to be practically the same as death camas. Neither the purple larkspur nor the death camas grows abundantly in localities which are far removed from foothills and mountains. The first green leaves appear during the latter part of April and the earliest flowers are observable about the first of May. A great variety of opinion prevails with respect to the poisonous character of this plant, some stockmen claiming that it is uniformly poisonous and others believing that it may at times be eaten with impunity. The evidence obtained by the writer as a basis for Bulletin 15 of the Montana Station, is believed to be conclusive in proving that the plant is poisonous for sheep in its early stages. The plant was called *Delphinium menziesii*, but recent systematic work on larkspurs indicated that this species is *D. bicolor*. Former experiments by Dr. S. B. Nelson, of the Washington Station, indicated that the true *D. menziesii* in the flowering stage was not poisonous. The apparent discrepancy of results is perhaps explained by the difference in species and the difference in stage of growth of the plant with which experiments were made.

During some seasons the purple larkspur causes extensive losses of sheep and calves in Montana. Cattle and horses eat it less frequently. As already noted, a great variation exists in the appetite of animals with regard to poisonous plants, and it is noteworthy that in the season of 1900 the purple larkspur was eaten very sparingly. Conclusive evidence against the plant was obtained only in one locality, and this among calves in the Flathead Valley. The symptoms of poisoning in these two cases were similar to those already outlined for poisoning by the tall larkspur in cattle, with the exception of a slight bloating observed in the calves. Respiration and pulse were very rapid, the body temperature was slightly lowered, and a profuse sweating was observed. Death occurred about four hours after the appearance of the first symptoms. In general, the symptoms of poisoning from purple larkspur closely resemble those produced by tall larkspur, and are distinguished from those of death camas by the absence of any regurgitation, which is characteristic of death camas poisoning, and by the presence of violent spasms, which are usually absent in poisoning from death camas.

In treating animals poisoned by this plant it is recommended that the same remedies be applied which were suggested in poisoning by the tall larkspur. In the writer's previous experience with this plant, atropine was found to be effective in counteracting the depressant action of the larkspur.

WESTERN WATER HEMLOCK (*Cicuta occidentalis*) (Pl. XXII).—This species is a smooth perennial, 2 to 5 feet high, with 3 to 10 elongated fleshy roots clustered at the base of an ascending axis 3 to 5 inches long, with twice decompound leaves and narrow serrate leaflets 2 or 3 inches in length, and flat-topped clusters with greenish white flowers. This plant is commonly known in Montana as wild parsnip, although a number of other plants have also received the same name in the State. It is generally distributed along the banks of streams, irrigation ditches, and marshy localities in the vicinity of ponds. The common name "wild parsnip" has apparently given rise to a mistaken notion that this plant is identical with the common parsnip of the garden, having established itself outside of cultivation. The two plants should be readily distinguished, the flowers of the garden parsnip being yellow, while those of water hemlock are white; the latter is also a much slenderer and less leafy plant than the former.

During the season of 1900 conclusive evidence was obtained that 36 cattle were poisoned from eating this plant, and of these 30 died. About 105 sheep were poisoned by it during the same year, 80 of which died. The mortality was, therefore, quite high, being 76 per cent for sheep and 87 per cent with cattle. The roots of this plant are occasionally eaten by man, usually with fatal results. During the season of 1900, in Montana, there were 5 cases of poisoning of human beings from eating this plant, resulting in 4 deaths.

The water hemlock, as already indicated, grows in wet places, and, except where grasses have formed a tough sod, the roots may be easily pulled up by the stem. It was not determined to what extent the roots are eaten by stock when pulled up in connection with the stem. In the case of sheep poisoning it was observed that the roots had been eaten and they were found in the stomach of the sheep. In other cases an examination of the place where the poisoning had occurred showed that some of the plants had been pulled with the roots attached and the latter left lying on the ground or that the plants had been eaten off without disturbing the roots. Observations in the field, which were confirmed by laboratory experiments, showed that during the early stages of growth the leaves and stems of the water hemlock, including the basal portion, contain sufficient poison to produce death. The roots are generally known to contain a virulent poison.

The remedies which were tried in cases of poisoning by water hemlock include morphine and chloral hydrate, combined in a few cases with emptying of the stomach by means of paunching and the use of cathartics. Potassium permanganate was not tried in any case, for the reason that the violent physiological effects of the poison were already manifested and it seemed necessary to counteract these symptoms. Morphine in one-fourth grain doses was given hypodermically to 2 sheep at intervals of five minutes. No decided effects of the morphine were noted until after the third dose, when the sheep became calmer. After receiving five doses both sheep lay down in an apparently stupefied condition, in which they remained for several hours. These sheep recovered after showing the effects of the poison for four or five days. An experiment was tried with chloral hydrate, during which 1 sheep was given one-half ounce in three equal doses at intervals of ten minutes. The effect of this substance was not so immediate, but seemed to be otherwise very similar to that of morphine. The sheep passed into a stupor from which it emerged after two hours. No further violent symptoms were manifested, but the animal did not recover its appetite, and finally died after three days. In another case where 10 cows were poisoned with water hemlock one cow was seen when the first symptoms of poisoning began to appear. The stomach was at once opened at the point where the ordinary operation of "paunching" is performed and the stomach contents removed. Melted lard and an enema of lukewarm water were administered without the addition of direct antidotes. The animal recovered after about two days without further care.

Water hemlock is an especially dangerous plant, since the symptoms of poisoning are so violent and are manifested so quickly. It is apparent that where several hundred animals are poisoned simultaneously and may die, as sometimes occurs, within fifteen minutes, great difficulty is experienced in administering even the simplest treatment to each animal.

The symptoms of poisoning from this plant are signs of acute pain with attempts to run away in any direction in which the animal happens to get started. Cerebral frenzy, accompanied with muscular spasms, are striking features. Respiration is labored and irregular, and the pulse hard and intermittent. Any attempt to manipulate the animal always results in increasing the mental excitement and the violence of the convulsions. In some cases of actual poisoning by this plant animals died within fifteen minutes after the first symptoms appeared. In other cases, both of young sheep and cattle, the animals lived from two to three hours, finally dying in violent spasms.

If the characteristic symptoms of poisoning from this plant have already appeared, chloral hydrate or morphine should be administered at once. If it is believed that a considerable quantity of the plant still remains in the stomach unabsorbed, a drench of potassium permanganate should be administered in order to destroy its poisonous property. A few cases are reported where this plant seemed to cause poisoning in hay. In general, it is advisable to remove specimens of water hemlock from hay before feeding. Since this plant ordinarily has a limited distribution in any locality, it might easily be eradicated by digging, especially along streams and ponds where sheep and other animals are driven for water.

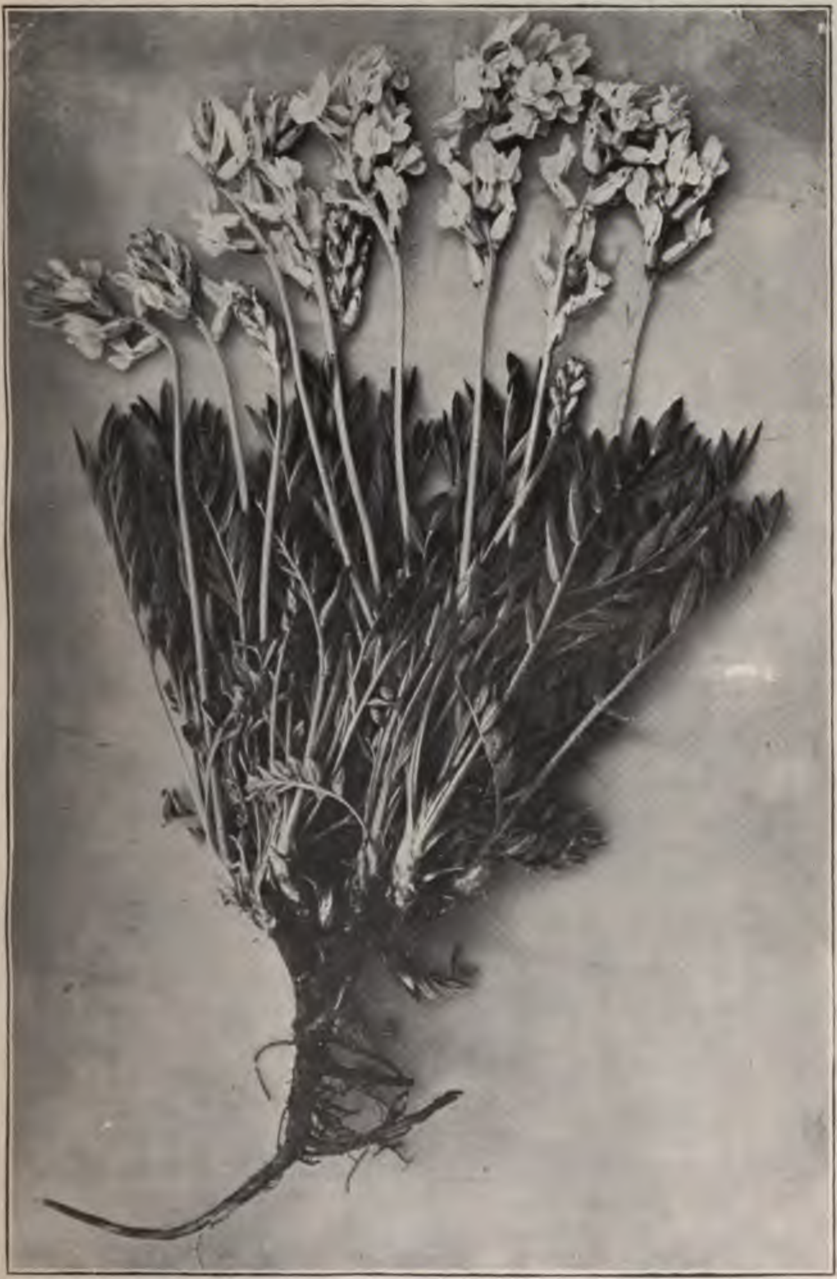
WHITE LOCO WEED (*Aragallus spicatus*) (Pls. XXIII, XXIV).—This is an erect tufted perennial, 4 to 18 inches high, with pinnately divided leaves and spikes of white or cream-colored flowers, shaped like those of the pea. The pod is one-celled, and when shaken produces a rattling sound, which gives the plant the name of "rattle weed" in some localities. The white loco weed is exceedingly common throughout Montana. It occurs most abundantly on the northern slopes of foothills up to an altitude of about 8,000 feet. Its preferred habitat is for the most part in rather dry situations. The habit of the plant varies in different parts of the State. In some localities the flowers are pure white, while in others they are decidedly yellow.

The loco problem has been an important factor with stock raisers for a number of years. In different parts of the country different plants are considered the chief offenders. In Colorado the plant which is most ordinarily known as loco weed is *Astragalus mollissimus*, while in Montana the species already named is perhaps most important; but there are others which have a rather wide distribution and are known to produce the same effects. Among these may be mentioned *A. splendens* (Pl. XXV), *A. lagopus*, and *A. besseyi*.

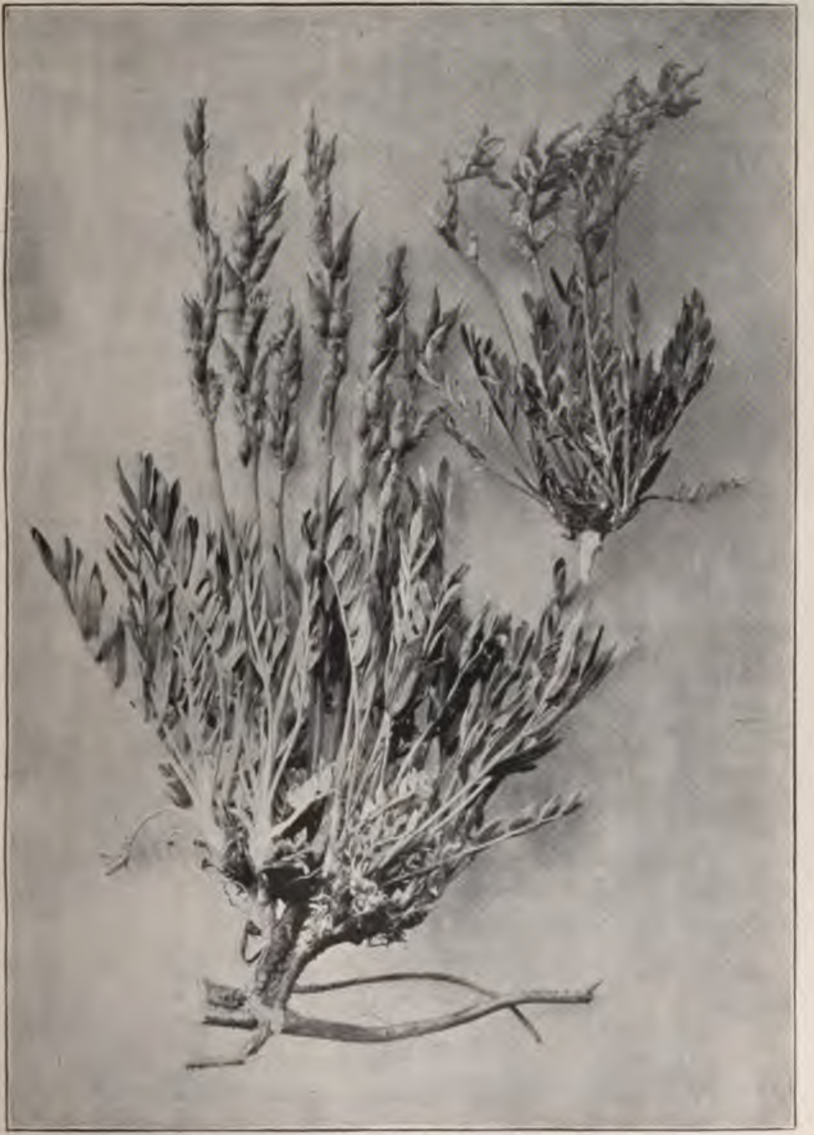
It is a common belief among a number of stockmen that the eating of large quantities of alkali may produce a locoed condition. There is no other evidence, however, for this belief, and there is considerable evidence to disprove it. On one stock range which was visited in the season of 1900, the loco disease had prevailed for a number of years, and the first cases were observed in sheep which were grazing upon a mountain range where no alkali was to be found in the soil or water. The white loco weed, however, grew in abundance, and sheep ate it in large quantities. After removing this band of sheep to a location on the plains where all the water was strongly alkaline and where the loco weed grew quite sparingly, a great improvement was noted in the sheep. The belief is gaining ground among the more intelligent stockmen that the failure to salt the sheep regularly may in many instances be the cause of sheep developing a perverted appetite, which is manifested by eating loco weeds to the exclusion of other more suitable forage.

The losses caused from the loco disease are very heavy in nearly all the Rocky Mountain States. The locoed condition is so commonly observed among sheep and horses that cases are not reported, and it is practically impossible to learn the exact extent of the disease. In the Judith Basin one prominent stockman was nearly ruined financially by the prevalence for a number of years of the loco habit among his sheep. In another instance the raising of horses was abandoned over a large tract of country on account of the loco weeds. During the season of 1900 about 650 locoed sheep and 150 locoed horses were seen during the writer's field work. The locoed horses were all in one herd, and of the 650 sheep, 500 were in one band and 150 in another. These numbers represent not more than one-fourth of the actual cases. A few locoed sheep and horses were to be seen on nearly every stock range.

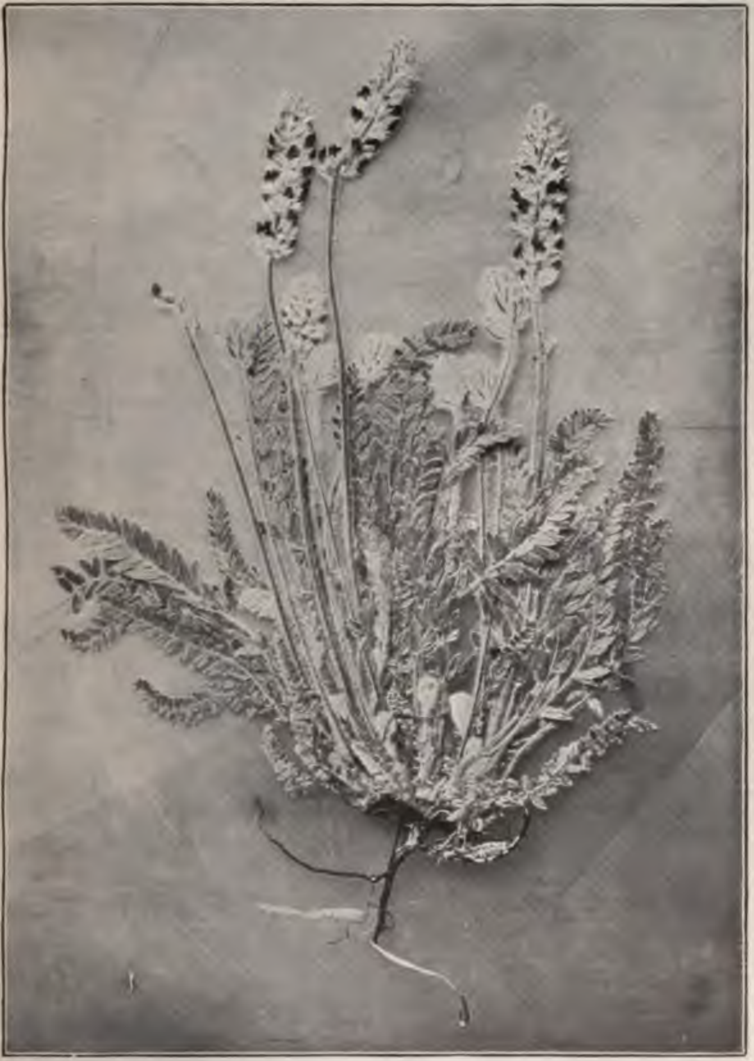
The loco disease occurs under two forms—an acute and a chronic. An acute case of loco disease was observed in a 2-year-old ewe with a lamb at her side. The ewe was observed eating large quantities of white loco weed on May 22, 1900. During the afternoon of the same day she became unmanageable, and the lamb was badly affected. An examination of the ewe at this time showed that she was completely blind and was affected with dizziness. She walked around in long circles to the right, and after a short period remained standing for



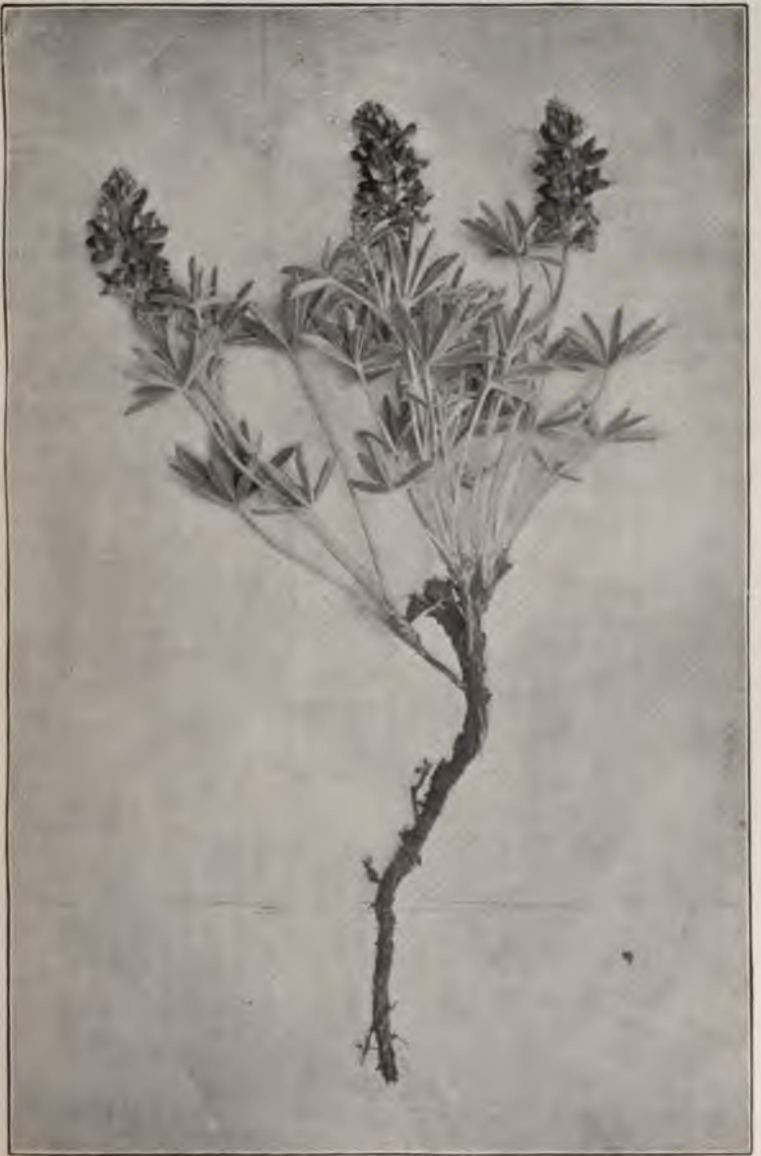
WHITE LOCO WEED (ARGALLUS SPICATUS) IN FLOWER.



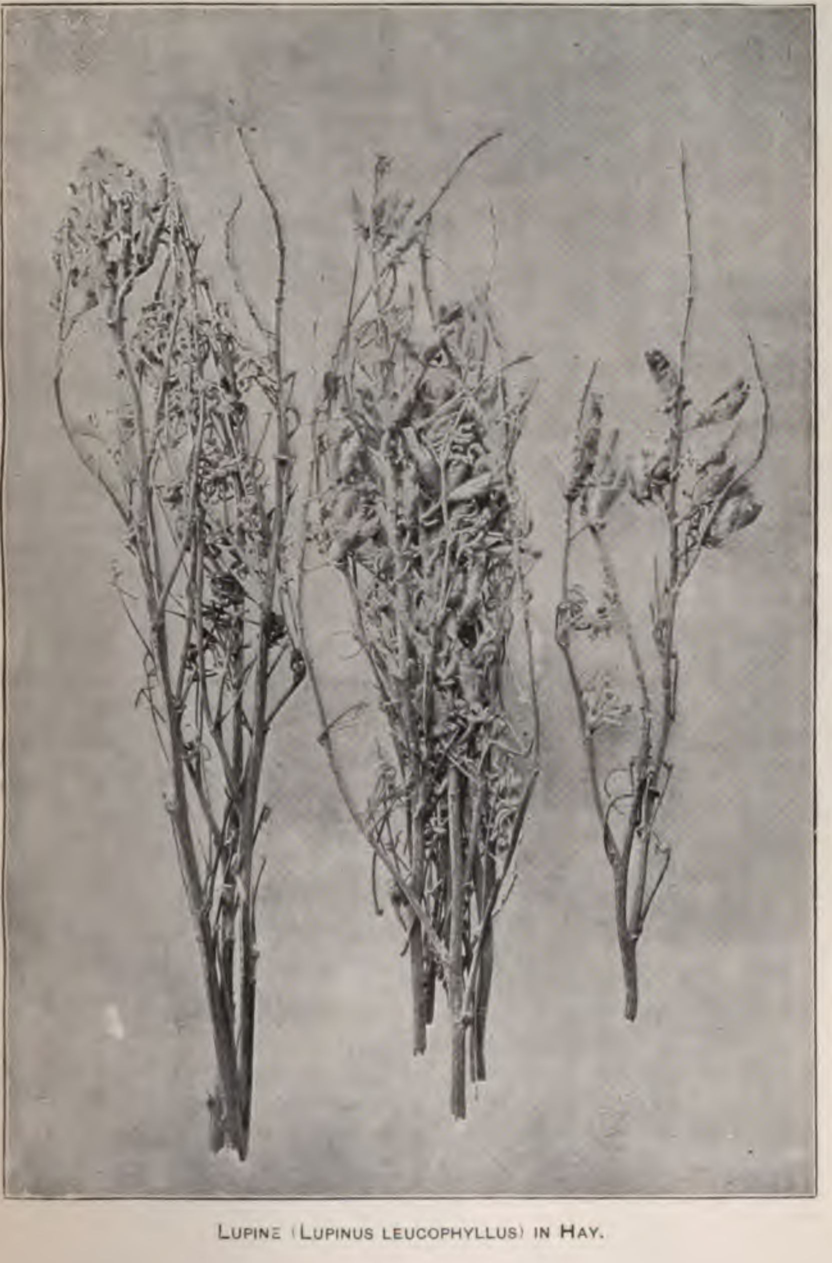
WHITE LOCO WEED (ARGALLUS SPICATUS), SHOWING SEED PODS.



Loco Weed (Astragalus splendens).



Lupine (Lupinus leucophyllus).



LUPINE (LUPINUS LEUCOPHYLLUS) IN HAY.

a few moments in a sort of stupor. At the beginning of each attack the head was elevated and drawn to the right; eyelids, lips, and jaws were moved rapidly. Each attack lasted from one to two minutes, and the intervals between the attacks lasted about five minutes. The second day the attacks became more severe and of longer duration, the head being turned more decidedly to the right and the animal sometimes falling upon the ground. Similar symptoms, accompanied by digestive disturbances, were manifested by the lamb during the second day, and it died during the afternoon. On the morning of the third day it was found that the ewe was pushing against the corral, and had apparently been in that position during the greater portion of the night. The animal then began to whirl around to the right. Later she became unable to stand, and the spasmodic movements were largely confined to the legs. On the morning of the fourth day she died. The pupil of the eye was at no time dilated, and the expression was nearly normal. The pulse was at first very irregular, but on the second day became again regular and of normal frequency. The only remedy which was tried was frequent injections of one-quarter grain doses of morphine, but this was without effect. Two other ewes ate smaller quantities of loco weed at the same time and were similarly affected, but less severely. In these cases morphine was tried with better success. The lambs, however, died from the poisonous properties contained in the milk of the mother.

The general symptoms of loco disease are quite familiar to all stock raisers. Perhaps the most characteristic are those of cerebral origin, and are shown in peculiarities of gait and action, which may be compared to a drunken condition. The brain disturbances may consist in impairment of the special senses or in irregular motor impulses, which produce incoherent muscular action. In some cases the animal becomes blind. More frequently the animal makes errors in judgment of the size and distance of objects. These visual disturbances are often quite ludicrous. The animal often takes flight apparently at imaginary objects, or at objects which under ordinary circumstances would cause no alarm. Locoed horses are somewhat dangerous for driving purposes on account of their tendency to run away. Such horses are frequently attacked with kicking fits without any apparent cause. The sense of hearing is often affected, and the response to sounds is irregular and out of proportion to the volume and character of the sound. Irregularities in muscular movements of sheep may assume a variety of forms. The animal may simply carry its head in an extended or otherwise unnatural condition. In some cases the back is arched. Trembling is a characteristic symptom. In locoed horses a great difficulty is sometimes experienced in persuading them to go backward. Locoed sheep are exceedingly difficult to manage. The different members of the band may suddenly take a notion to run away in different directions, with the result that it is almost impossible for the herder to prevent their becoming separated. In cattle the disease appears to be rare, although symptoms, so far as observed, are essentially the same as those in sheep and horses. Occasionally locoed cattle manifest dangerous symptoms, and attack men and other animals. The belief is quite general among sheep raisers that one of the effects of eating loco weeds is an elongation and loosening of the teeth. This symptom is ordinarily mentioned as characteristic of the locoed condition. Dr. M. E. Knowles, State veterinarian of Montana, suggested that this was merely the natural process of shedding the teeth, which occurs in sheep at about the age of eighteen months. It hardly seems possible that the loco habit would cause such a peculiar phenomenon.

In chronic cases of loco the animal gradually becomes more emaciated and crazy. In sheep the fleece may be shed in patches or as a whole. The animal becomes unable to care for itself, and is apt to fall into the water while attempting to drink. Fits of trembling are of frequent occurrence, and the animal finally dies of inadequate nutrition and total exhaustion. In chronic cases of loco disease in horses the animal is usually left to its own resources on the range. During the later stages it may remain for weeks at a time upon a small area of ground without taking water. The writer had the opportunity of observing a number of such cases in horses that were almost unable to walk. Under such circumstances the animals seldom or never lie down. One horse which was seen remained for a period of two weeks, in 1897, upon a piece of ground about 150 feet square. During this time the horse had no water.

Numerous autopsies on locoed sheep and horses revealed conditions which, though fairly uniform, do not constitute a well-defined series. A slight congestion of the brain membranes was observed in all cases. The lungs and heart were in normal condition. Fatty tissue was considerably reduced in quantity, and the muscles were paler in color than under normal conditions.

The most serious mistake in connection with loco disease is made in allowing locoed sheep to remain with the rest of the band. The loco habit is apparently learned by imitation of locoed animals, and so long as locoed sheep are allowed to remain with other sheep the loco habit rapidly spreads. On one sheep range the writer found 500 locoed sheep in one band. The owner of this band stated that the number of locoed sheep in the band was constantly increasing, and that at the same time the worst cases were dying from time to time. The habit of eating loco weeds had prevailed on this range for two years, and during the winter of 1899 the owner had lost 700 sheep from loco disease. Another band of sheep belonging to a neighboring sheepman accidentally came in contact with this band during the spring of 1900. In the early part of

May the herder of this second band reported two or three cases of locoed sheep in his band. On June 25, when this band of sheep was brought to the shearing shed, the number of locoed sheep was found to be increased to 150. In another part of the State an experienced sheep raiser, after being nearly ruined financially through the loco disease, adopted the method of immediate isolation and the feeding of locoed sheep for mutton. His stock was replaced with sheep that were free from the loco habit, and the trouble has been entirely eradicated from his range.

No specific remedy for the loco disease has been discovered, and in the nature of the case no such remedy is likely to be found. In the present state of knowledge concerning the subject the only rational treatment to be recommended is that of confinement and feeding with a nutritious diet. By separating the locoed sheep at once from other sheep the spreading of the habit will be prevented, and the locoed animals may be fattened and thus prevented from becoming a total loss. A sheep raiser of the Yellowstone Valley in the fall of 1899 discovered 1,200 cases of loco disease among his sheep. These 1,200 were immediately separated from other sheep and put together in the feeding corral along with 1,000 other locoed sheep which were bought from other sheep men. These 2,200 locoed sheep were fed upon alfalfa and roots for a period of two months. At the expiration of this time all the sheep, with the exception of about 50, had apparently made a complete recovery from the loco disease, and were in a good condition for market. Nearly all of the 50 remaining were separated from the band on account of being cripples. Although locoed animals may readily be fattened and sold for mutton, their recovery from the loco habit is apparent only, and is due to their inability to obtain the loco weed. Such animals when allowed to run upon the range again almost invariably return to their old habit of eating loco weed. Animals which have once been locoed are, therefore, unsuitable for stocking the range.

In combating the loco disease the most rational methods include salting of the sheep regularly, the immediate removal of locoed sheep from the band, confining them in a corral, and feeding them upon a nutritious diet. They may thus be fed for market and their pernicious habit will not spread to other sheep. In the case of locoed horses, an apparent recovery takes place if they are confined in a stable and fed on ordinary cultivated forage or allowed to run in pastures where no loco weeds are found. Such horses are always somewhat dangerous and more apt to run away or become unmanageable than horses which have not become affected with this disease.

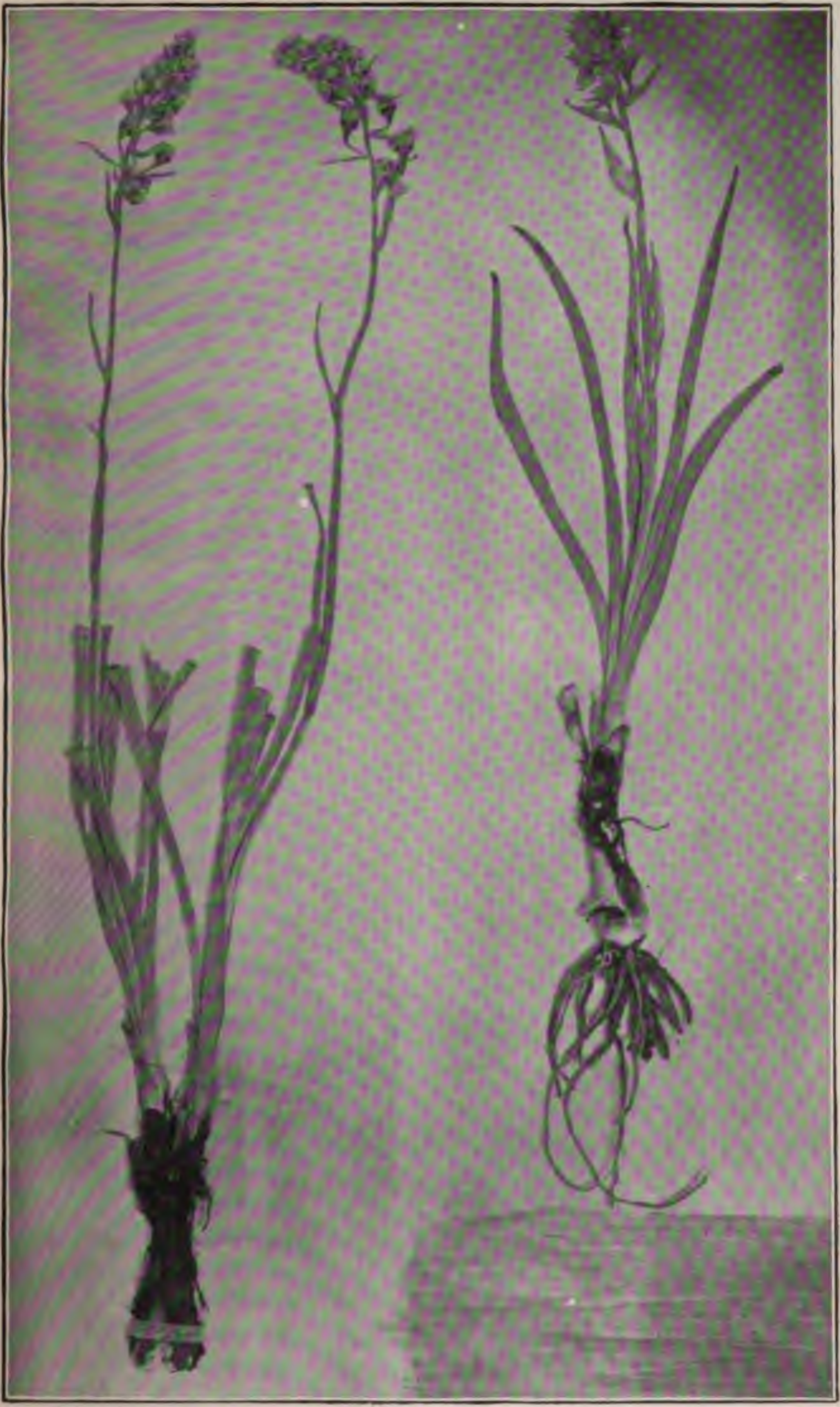
LUPINES (*Lupinus leucophyllus* (Pls. XXVI, XXVII) *L. sericeus*, *L. cyaneus*).—These plants are commonly known by the names blue pea, blue bean, and wild bean. They are coarse, silky haired perennial herbs, with blue flowers arranged in conspicuous terminal racemes, which blossom in June and July, with long-stemmed leaves which are divided into from 7 to 11 leaflets radiating from a common point. The fruit is a hairy, several-seeded pod, and the seeds are small and somewhat flattened. The three species above mentioned are very similar in general appearance and can only be distinguished by the systematic botanist.

Lupines are generally distributed throughout Montana, and should be readily distinguishable from all native plants on account of the character of the leaves and flower clusters. As a rule these plants do not occur in the flat river bottoms. They occur most abundantly on the foothills and mountain ranges at moderate elevations. In many parts of the State lupines are so abundant in such locations as to cover the ground completely over large areas. In such cases the lupines may be cut for hay, and several thousand tons of such hay are annually cut in Montana.

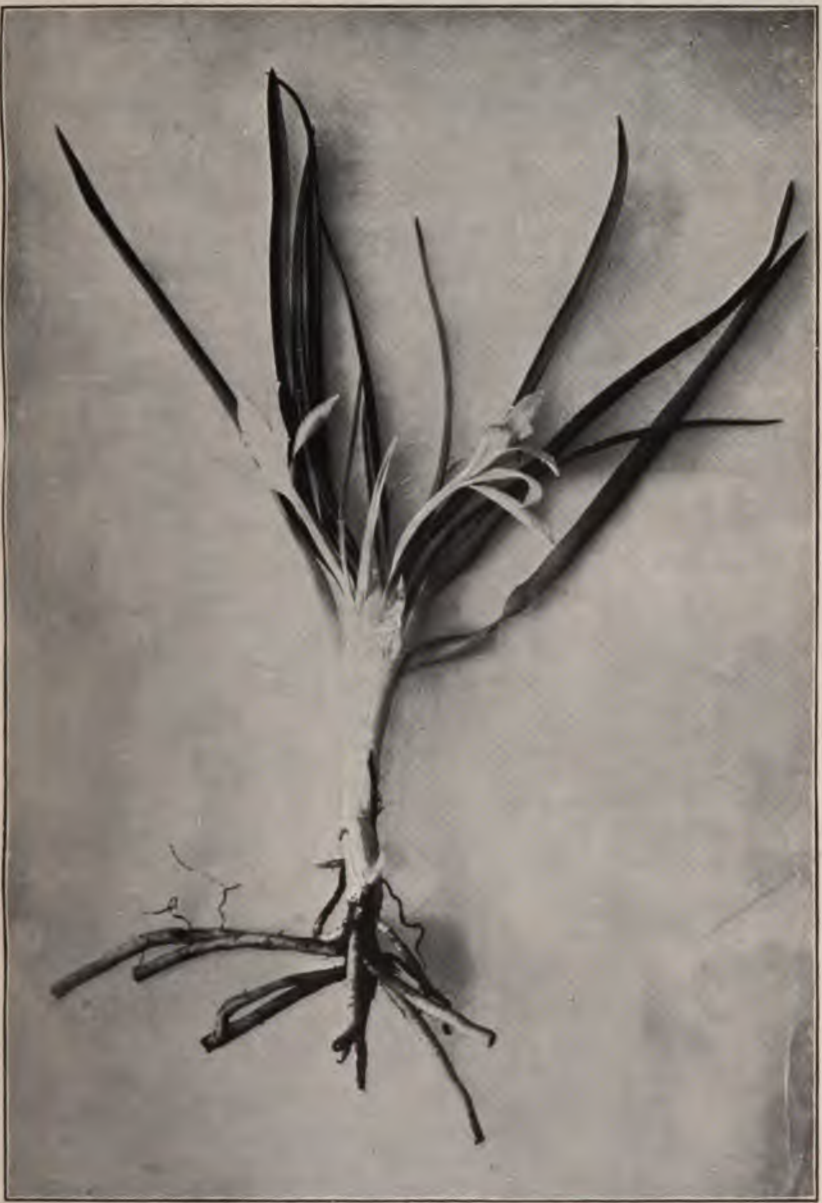
During the season of 1900 the lupines began to bloom about May 20, and the first full pods were collected on June 5. Lupines are not very extensively eaten by sheep during the spring and summer, except when they are unusually hungry or are being driven from one range to another. Lupines are more often eaten by sheep in summer on the mountain sides and in the fall and early winter after early frosts have opened the pods and the seeds have fallen out. Lupine hay (see Pl. XXVII) is greedily eaten by all kinds of stock during the winter, and large quantities of this hay have been fed for the past fifteen or twenty years. Lupine hay is cut by different stockmen at different seasons. Where considerable dependence is put upon wild hay, the time of haying depends upon the press of other business. It therefore happens that lupine hay is cut in different years at dates ranging from the first of July to the middle of September. When cut during the first half of July, the newly ripe pods, full of seeds, are secured in the hay. When, however, the harvesting of lupine hay is postponed until September, the pods become ripe and split open, and the majority of seeds fall out. A striking variation in the quantity of pods containing seeds is noted during different years. During seasons in which May and June are wet, the quantity of pods is usually large. When, however, these months are dry, only a few pods are found on each plant and a vast majority of the flowers fail to be fertilized.

The writer has frequently observed that sheep are especially fond of the pods of various leguminous plants before they become mature and while they are still in a succulent condition. In some parts of Montana it was noticed that sheep fed extensively on the pods of lupines and other legumes.

The first case of poisoning from lupines which was brought to the attention of the writer occurred in August, 1896. A band of sheep



SWAMP CAMAS (ZYGADENUS ELEGANS).



WILD HYACINTH (LEUCOCINUM ONTANUM).

while being driven from one range to another, in a hungry condition, was allowed to feed upon an area of lupines in a nearly ripe condition. Within two hours the sheep manifested violent symptoms of poisoning, and ultimately 100 out of the band of 200 died. In the winter of 1897 a band of 150 bucks, after having been fed during the winter on cultivated hay, were given a liberal quantity of lupine hay during the afternoon. About three hours after feeding, symptoms of poisoning developed. The sheep were found to be in a frenzied condition, and 90 of them died during the night.

In August, 1898, a horse came under the observation of the writer two hours after having eaten a liberal quantity of lupine hay. The animal showed the usual symptoms of lupine poisoning, but recovered after a period of about three days. In the winter of 1897, three 2-year-old colts were fatally poisoned by feeding with lupine hay. The animals died on the second day after feeding.

During October, 1898, about 2,000 sheep died in various parts of Montana as a result of eating lupine upon the range. During this season the seeds, contrary to the usual occurrence, had been retained until after heavy frosts. An examination of the stomach contents of the poisoned sheep showed that in all cases lupine was almost the only food material. Stems, leaves, and pods of this plant were identified in the stomachs, and the abundance of pods and seeds was especially striking. During the winter of 1898–99 more than 3,600 sheep died from eating lupine hay in Montana. This number of deaths occurred among 7,000 sheep which were affected. The death rate was therefore about 50 per cent. In these cases the lupine had been cut at a much earlier date than usual, and at a period when the pods were full of nearly ripe seeds. The most extensive losses of sheep from feeding lupine hay occurred in the Judith Basin. At one ranch on Sage Creek 2 tons of lupine hay was fed to a band of 2,000 sheep, with the result that 700 died within a period of forty-eight hours. In order to determine the cause of the poisoning, 200 pounds of the lupine was fed to 50 sheep from another band. Some of these sheep died before finishing their meal, and, altogether, 28 died within a period of twenty-four hours. Similar experiences were had during the same winter on a number of other sheep ranges. In the Deer Lodge Valley an experienced sheep raiser, who had for several years fed lupine hay, cut a portion of his hay during the first half of July. Haying was then interrupted until September, when the rest of the lupine was cut, and the stack which had been begun earlier in the season was completed. During the following winter, when this hay was fed, the lupine which was cut late in the season caused no trouble. The first feed, however, which was given from the bottom of the stack of lupine, which was cut in July, caused the death of about 700 sheep. The disastrous result of allowing sheep which are unacquainted with lupine to feed where this plant grows in abundance is well illustrated by the case of a train load of sheep which were unloaded near the Mullen Tunnel, at an altitude of 6,000 feet. The shipment was made in July, and the sheep were unloaded in a ravenously hungry condition. Since lupine constituted the most conspicuous forage material accessible to the sheep, they ate great quantities of the pods and leaves. Within a few hours a large number of sheep showed signs of poisoning, and 400 died.

The most disastrous case of sheep poisoning which the writer has observed in Montana occurred on June 28, 1900, about 5 miles west of Livingston. Two bands of sheep, each numbering 3,000, had recently been imported from Oregon and were being "trailed" west along the railroad track. The two bands of sheep were driven over parallel but slightly different courses during the day and arrived at the same point at night. One band came in contact with a considerable quantity of lupines (*Lupinus cyaneus*) in a ripe condition and ate large quantities of the pods. The other band followed a course by which no lupines with pods could be obtained. The first band was driven across a small stream, where both were watered, and after crossing the stream found and ate considerable quantities of lupine pods. During the night symptoms of poisoning developed, and ultimately 1,900 out of the 3,000 sheep in the first band died, while none in the other were affected. A preliminary investigation of this case led the writer to suspect malicious poisoning. A subsequent post-mortem examination of about 75 sheep showed that all the sheep that died had eaten large quantities of lupine pods in a ripe condition. The symptoms were such as were observed in other cases of lupine poisoning, and the evidence as a whole pointed conclusively to lupine as the cause of death.

On June 26 two sheep were given each 150 medium-sized lupine pods (*L. leucophyllus*) which were entirely full of ripe seeds. The sheep ate the pods readily. Both sheep became frenzied within about forty-five minutes after feeding upon the lupine pods, and died about one hour later. The symptoms in these cases were the same as those observed in poisoning under natural conditions.

The symptoms of lupine poisoning are so well known in Europe that chronic lupine poisoning has been given the name *lupinosis*. In this country the chronic form has not been observed. In cases of lupine poisoning in Montana there was noted an acute cerebral congestion, accompanied with mental excitement. The sheep rushed about in different directions, butting one another and other objects. The first stage of frenzy was soon followed by a second stage, characterized by pronounced irregularity of movement, spasms, and falling fits. In the majority of cases death occurred in from one-half to one and one-half hours. In extensive cases of lupine poisoning it was uniformly observed that a number of the sheep lingered on from two to four days before they died. The muscular convulsions resembled those caused by strychnine. The excretion of the kidneys was much increased and frequently was bloody. Postmortem examinations of sheep poisoned by lupines revealed conditions similar to those in acute forms of loco disease, with the addition of a congested condition of the kidneys.

No remedies have been tried in cases of stock poisoning from American species of lupine. From our general experience with potassium permanganate it seems reasonable to suppose that this substance would probably destroy the lupine alkaloids in the stomach if administered promptly after the first signs of poisoning. In the main, however, reliance should be placed upon prevention. With regard to the use of lupine hay, our experience and observations indicate that this is always dangerous for sheep if cut at a time when the seeds are retained in the hay. Since the limit of the period during which lupines are not poisonous can not be determined for the present with any certainty, it seems advisable to abandon entirely the use of lupine hay for sheep, except after a preliminary test in feeding large quantities of the hay to one or two sheep. If it should prove to be non-poisonous, it may then, of course, be fed with safety.

The poisonous principle in all plants which have been fully investigated varies in quantity according to the stage of growth of the plant, and is located more abundantly in one part of the plant than in another. These facts seem to be strikingly true of lupine, since, as already indicated, the plants are sometimes eaten in large quantities with impunity, while at other times the plants cause extensive losses, especially among sheep. The evidence thus far collected regarding this matter indicates that the seeds are the most poisonous part of the plant.

LESS IMPORTANT POISONOUS PLANTS AND PLANTS WHICH ARE SUSPECTED OF BEING POISONOUS.

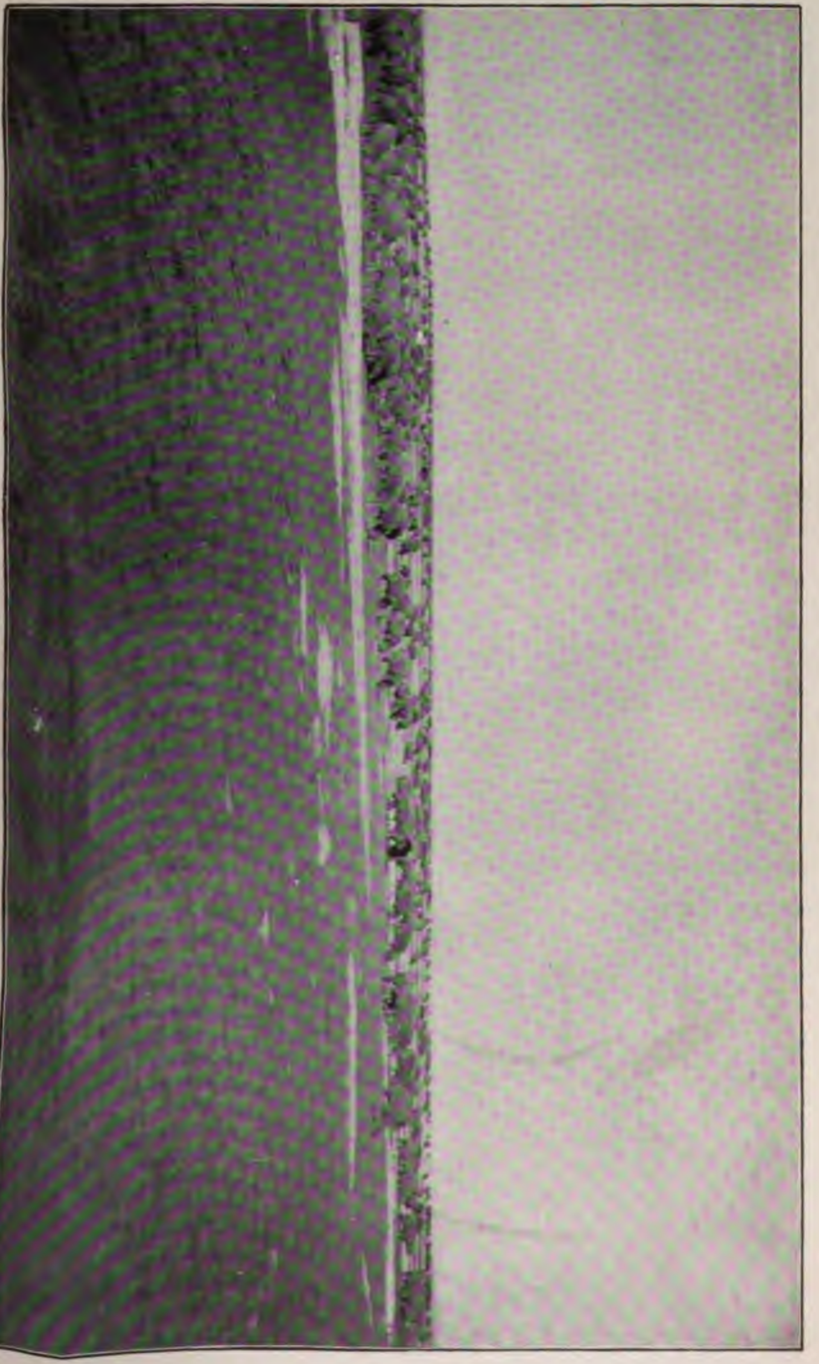
ERGOT.—Besides the poisonous plants of more importance, which have already been discussed, there are a number of other species which are known to be poisonous or which are suspected of being poisonous by stockmen. Perhaps especial mention should be made of ergot on account of the great prevalence of this parasitic fungus on a considerable variety of grasses in Montana. Ergot is most abundant on wild-rye grass and bluejoint. The form in which this fungus is most readily seen is that of a black, straight, or slightly curved spur, from one-fourth to one-half inch in length from the fruiting head of the infested grass. Bluejoint and wild-rye grass are extensively cut for hay, and when badly infested with ergot are exceedingly dangerous fodder. In addition to the ordinary form of ergotism, which is well known to cattle raisers, the following case was apparently due to extensive eating of ergot, in which the symptoms were quite unusual. In 6 horses which had been feeding for several weeks on infested bluejoint hay symptoms of paralysis developed, beginning first with the muscles of the throat and gradually extending over the whole body. An attempt was made to counteract these symptoms by alcoholic stimulants and hypodermic injections of strychnine, with success in 2 cases only. The other horses died of general paralysis within from six to eight hours. A number of cases of the ordinary form of ergotism were observed in Montana, and, as attention has already been called in Iowa to the constitutional effects of continued eating of ergot by domestic animals, it seems highly probable that the great prevalence of ergot in Montana may be the cause of many unexplained cases of plant poisoning in the State.

It was learned in conversation with stockmen during the season of 1900 that the ergot spurs are quite generally considered as being the seeds of the grasses which they infest. The difference between ergot spurs and seeds of grasses may be easily learned and should be known by all persons who handle stock.

SWAMP CAMAS (*Zygadenus elegans*) (Pl. XXVIII).—This species resembles death camas in general habit. It differs from the latter in its greater height, larger flowers, and wider leaves. It grows in more moist situations than death camas. Marsh hay containing a large quantity of swamp camas and cut in the fall of 1899 proved on the first feeding to be poisonous to sheep. An examination of the remaining portion of hay showed that no other plant was present which could be considered poisonous. The seeds of the swamp camas were probably the cause of the poisoning in this case. During the season of 1900 six cattle were poisoned while feeding in a pasture where swamp camas grew in abundance, and two of the animals died. The symptoms of poisoning were nearly identical with those manifested by sheep in poisoning by death camas and postmortem examination revealed a similar anatomical condition. Large quantities of swamp camas were found in the stomachs of the dead animals.

Among the plants in Montana of restricted distribution which are known to be poisonous mention should be made of the California swamp hellebore (*Veratrum californicum*), black henbane (*Hyoscyamus niger*), and spreading nightshade (*Solanum triflorum*).

A large number of plants have been suspected of being poisonous by various stockmen. In some cases the evidence is apparently quite convincing that they are poisonous to a slight extent, while in others there is absolutely no evidence on one side or the other. Many plants belonging to the parsley family have been called indiscriminately by the name wild parsnip, and they have been generally suspected. No definite evidence was obtained against any one of these plants. The



A typical Range in Montana, showing Sheep well scattered.

A typical Sheep Range in Montana in Winter.

LAMBING FLOCK NEAR GREAT FALLS, MONT.

false lupine (*Thermopsis rhombifolia*) has been suspected of being poisonous, and in one case, where 100 cattle died on a range near Wejbaux during the season of 1900, this plant grew in abundance and had been eaten to some extent. Otherwise, no evidence was obtained against it. This plant is also known by the name of yellow pea among stockmen; it is frequently eaten by sheep without serious effects, and is cut for hay to some extent.

One instance of the apparently poisonous effects of oat smut was observed by the author in Gallatin Valley. A crop of oats which was badly infested with smut was cut before maturing and stored for hay. This hay was fed to a dairy herd in the following winter with the result that 12 cows died of gastritis and frenzy after a period of about twelve hours. On postmortem examination the stomach walls were much congested, showing a decided irritation.

A number of plants have been suspected of being poisonous from fancied resemblance to plants which are known to be poisonous. One curious confusion of species has already been referred to by which a number of stockmen referred to death camas as wild onion and then considered the wild onion as being poisonous. No evidence is obtainable for believing the wild onion to be poisonous. Wild licorice has at times been suspected of causing poisoning, although it is well known that a large quantity of this plant is cut for hay and fed with impunity. The green plants are also frequently eaten by cattle and horses on the range. The wild hyacinth (*Leucocinum montanum*) (Pl. XXIX) has been repeatedly sent to the writer with statements concerning its alleged poisonous nature. It has been supposed by some that the seeds or the roots were poisonous; but since the seed capsules are formed under ground and the plant grows in such dry situations that it is practically impossible to pull up the roots, it is difficult to see how stock could ever feed upon these portions of the plant. No evidence whatever has been obtained which could connect this plant with any case of poisoning. The cow parsnip (*Heracleum lanatum*) is occasionally called wild parsnip and consequently considered poisonous. The plant is much coarser than the water hemlock and is known to be harmless. The false mallow (*Malvastrum coccineum*) is well known for its showy, brick-red flowers, which blossom in May and June. This plant has been accused of being poisonous, but it was found during the season of 1900 that it is extensively eaten by sheep on certain ranges and was well known to be a valuable forage crop by Mr. W. C. Gillette, on whose range it had been eaten by sheep for a number of years.

RABIES: ITS CAUSE, FREQUENCY, AND TREATMENT.[1]

By D. E. SALMON, D. V. M.,
Chief of the Bureau of Animal Industry.

RABIES IN THE DISTRICT OF COLUMBIA.

In December of the year 1892 the brain of a man who had died of a mysterious nervous affection was brought to the laboratory of the Bureau of Animal Industry for examination. It was thought that the symptoms exhibited by the patient resembled somewhat those of hydrophobia, but the physician hesitated to make this diagnosis, as it was not known that rabies existed among the dogs in the District of Columbia, and as the opinion had been widely circulated by certain authors, supposed to have knowledge of the subject, that the disease was so very rare that a single case could not be found by years of energetic search. A careful consideration of the symptoms, however, led to the inoculation of rabbits in order to test the theory of hydrophobia, and somewhat to our surprise, these rabbits in due time became affected with and died of rabies. As the rabies of animals is identical with the hydrophobia of man, and as hydrophobia is practically always contracted from the bite of a rabid animal, the result of this experiment was a demonstration that the man had died of hydrophobia, with a strong presumption that rabies existed among the animals of this section of the country.

Owing to the supposed infrequency of the disease, this case aroused considerable interest; and when, in the following month (January, 1893), information was received that a horse had been destroyed in the city of Washington because it was thought to be affected with rabies, further inoculations were made from the brain of this animal. The rabbits used in this experiment also became affected with rabies.

About this time a disease of cattle was under investigation by the Pathological Division of the Bureau, and the conclusion was reached that the disease was rabies; but before making a definite decision it was thought advisable to compare it experimentally with the rabies of dogs. Several veterinarians were accordingly requested to bring to the experiment station all dogs suspected of rabies, and the superintendent of the station shot a number of dogs which appeared to be affected. These dogs were all tested by inoculation experiments, and from March 24 to December 12, 1893, eleven were found affected with rabies.

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[1] This article also appears in the Yearbook of this Department for 1900.

As the investigations which required the virus of rabid dogs were closed in 1893, no further effort was made to procure cases, and no more were recorded until the fall of 1895. Interest was revived in the subject at that time by the death of a woman in Washington from this dreaded disease. Inoculations were made from the dog which bit this woman, but unfortunately the disease developed in the patient at the same time as in the inoculated rabbits, and there was, consequently, no opportunity for prophylactic treatment. This case was reported by Dr. Behrend to the Medical Society of the District of Columbia, and attracted considerable attention.

Arrangements were now made between the District health officer and the chief of the Bureau of Animal Industry whereby all dogs or other animals suspected of having rabies were to be sent to the Bureau laboratory in order that a positive diagnosis might be made. As a result of all these investigations, the number of cases of rabies which have been positively diagnosed and recorded in animals is as follows: 1893, 11 dogs, 1 horse; 1895, 4 dogs, 2 foxes; 1896, 5 dogs; 1897, 2 dogs, 1 cow; 1898, 7 dogs; 1899, 19 dogs, 1 cow, 1 cat; 1900, January to August, inclusive, 32 dogs, 3 cows, 1 horse, 1 cat. The total number of animals which have been proved to be suffering from rabies in the period from 1893 to August, 1900, is therefore 91. Twenty-eight persons were reported as having been bitten by these rabid animals. The records of the health department of the District of Columbia show 7 deaths of human beings from hydrophobia since August 1, 1874.

These developments were entirely unexpected. It was not supposed before the investigations began that rabies existed to this extent anywhere in the United States. Instead of being an extremely rare disease, to be found but once or twice in a lifetime, even by those who are diligently seeking it for the purpose of investigation, as has been represented, the facts cited show that rabies has existed for years almost continuously at the National Capital.

THE DISTRIBUTION OF RABIES IN THE UNITED STATES.

In order to learn something of the occurrence of rabies in other parts of the United States, information was requested of veterinary schools, State veterinarians, and other persons who would probably be in possession of such facts. A number of very carefully prepared replies were received, from which the following summaries have been made:

Dr. Charles P. Lyman, dean of the School of Veterinary Medicine, Harvard University, Boston, Mass.: During an outbreak of rabies, which was recognized as existing in Boston, there suddenly appeared in Harvard Square, Cambridge, one morning, a large crossbred Newfoundland dog. The animal entered a butcher shop and behaved in such a manner as to induce the butcher to throw him a bone and drive him away. The dog seized the bone and went into the street, and after gnawing for a short time he went one after another to 5 dogs and bit them all. He also bit a horse rather severely in the upper lip. The 5 dogs came under Dr. Lyman's professional care, and 3 of them died, showing all the symptoms recognized and described in the books as belonging to rabies. The wound on the horse was seared with a hot iron probably within thirty minutes from the time the injury was inflicted. Notwithstanding this treatment, the horse contracted the disease recognized and described as being rabies.

During a subsequent outbreak a dog bit a policeman on the streets of Lynn. This man declined to take the Pasteur treatment, said he was not afraid, and would take his chances. Within a short time he was taken ill with symptoms recognized by the local medical men as being those of hydrophobia, and he died after dreadful suffering.

Dr. Lyman estimates that there have been 25 to 30 cases of rabies observed at the Harvard Veterinary School during the last eighteen years.

Dr. W. J. Coates, chief surgeon of the American Veterinary College, New York: In looking over record books finds on the average about 7 cases a year for the past twenty-five years. Has never seen a case of rabies in man.

Dr. H. D. Gill, professor of surgery in the New York American Veterinary College, formerly dean of the New York College of Veterinary Surgeons: During the month of May last (1900) 3 positive cases of rabies came to the hospital, one dog having bitten the three. For the past three years the average was 8 cases a year.

Dr. Robert J. Wilson, assistant bacteriologist, Department of Health, city of New York: Has confirmed the diagnosis of rabies in about 40 cases in domestic animals, and 3 in the human subject. His attention has also been called to 2 other undoubted cases in that city, where no opportunity was afforded to prove the diagnosis. All of these cases have been observed during the past three years.

Dr. Wilfred Lellmann, professor in the New York American Veterinary College, formerly of the New York College of Veterinary Surgeons: Has been lecturing on canine pathology for the past six years. During the last session has demonstrated to the students 4 evident cases of rabies. In his private practice met with 1 case. Of these 5 cases, 4 were mute rabies, while the 1 in private practice was of furious rabies. Besides these 5 cases, he saw 2 more at Dr. Gill's clinic. A physician, Dr. Schwyzer, a friend of his, has observed a case of rabies in a man at the German Hospital in New York City.

Dr. Leonard Pearson, dean of the department of veterinary medicine, University of Pennsylvania, and State veterinarian: A great many cases of the rabies have been brought to the hospital connected with this school. Can not tell without looking over a great many records just how many. Estimates that during the fourteen years' existence of the school from 300 to 400 unquestionable cases of rabies have been received in the hospital. Knows of several cases of rabies in man that have occurred in Pennsylvania, and the diagnoses in some of these cases have been confirmed by the inoculation of animals with pieces of the brain. During the last year there have been 2 fatal cases in Lancaster, 1 in Kennett Square, 1 in Philadelphia, and 1 in Allegheny. Three years ago one of the prominent veterinarians of Pennsylvania died of rabies following the bite of a rabid dog. There has been a great deal of rabies among the farm animals in different parts of the State. Cattle, swine, sheep, and horses have developed rabies of the furious form after having been bitten by a mad dog. A great many of these cases have been examined very carefully, and the diagnoses have been sustained by the results of laboratory examination.

Dr. J. M. Wright, professor in McKillip Veterinary College, Chicago (writing under date of April 5, 1900): Since January 1, 1900, his attention has been called to 11 cases in the dog and 3 in the horse. During the last year he has handled 20 cases, which is a fair yearly average.

Dr. A. H. Baker, professor of theory and practice and dean of Chicago Veterinary Col-

lege: "Many cases of rabies in dogs and horses have been brought here. We have kept no record of the number of cases, but I can safely say that during the last year we have had at least 10 cases in horses and 50 in dogs. I have never seen a case of rabies in man. I may add that we are sincere believers in the Pasteur preventive treatment for rabies in man."

Dr. James Law, director of New York State Veterinary College, Cornell University, Ithaca, N. Y., says:

"This particular locality has never, to my knowledge, since 1868, furnished a single case of *casual* rabies. It has, however, been repeatedly sent to us from different parts of the State (Chatham, Saratoga, Buffalo, etc.) in the form of brains of the diseased animals, from which small animals were experimentally inoculated and the disease produced, so as to confirm the original diagnosis or suspicion.

"I know of the case of Neil, the keeper of the dog pound at Newark, N. J., who died of rabies consequent on the bite of a rabid dog. I brought a portion of his medulla to Ithaca and inoculated a dog and a number of rabbits, some on the brain and others subcutaneously, with the result that all showed rabies after the customary periods of incubation. I have the best of evidence of a number of men who contracted rabies after the bite, and from whom (saliva or brain) inoculation of the disease was successfully made on the lower animals to prove its infective character.

"On the other hand, I know of a number of cases in which people who had been bitten by dogs have developed symptoms of hydrophobia as the simple result of fear, mimicking the symptoms as nearly as their knowledge of the disease would guide them. * * * The unreal nature of such fanciful cases is not, however, any disproof of the actual infections in which the virulent saliva or brain of the human victim has produced rabies in the lower animals in a continuous series, though they can have no apprehension of such a result. The person who denies the real because there exists a counterfeit is in this case an exceedingly dangerous person, about as much in need of seclusion as the rabid dog itself. The disease prevails at present in Erie County, N. Y."

Dr. S. Stewart, secretary Kansas City Veterinary College: Eleven or 12 cases have been brought to the hospital during the last three years, 5 within one year. No cases of rabies in man have come under his personal observation. Four or more authentic cases have occurred in that city in past five years. Typical, well-marked cases in dogs, horses, cattle, and swine have come under his personal observation.

Dr. John J. Repp, professor of pathology and therapeutics of veterinary department, Iowa State College of Agriculture and Mechanic Arts, says:

"Since my connection with this school, a little over a year, no case of rabies has been brought to it. By consulting the records, I find that no case of rabies has been brought to this school during the twelve years covered by them. * * *

"During the past winter Dr. J. R. Sanders, Corydon, Iowa, has noted the death of 18 cattle in his vicinity, 7 out of one herd of 50, all showing rabiform symptoms. He killed one of the seven out of the herd of 50 when it was suffering from these symptoms in a violent form, removed the cerebellum and medulla oblongata, according to my direction, and sent them to me packed in ice. I received the tissues in excellent condition, and at once inoculated a rabbit subdurally with a small portion of a mixture made with sterile water and about one-eighth of a cubic centimeter of the medulla cut from the floor of the fourth ventricle. On April 7, two weeks and four days after the inoculation, the rabbit died, after four days' suffering, from gradually increasing paralysis. * * * My diagnosis, therefore, is that the steer from which the tissues were taken was suffering from rabies at the time of his death, a diagnosis borne out by the symptoms presented. If this steer had rabies, it is presumed that the other cattle suffering in like manner had rabies also.

"During my four years' residence at the University of Pennsylvania I saw a large number of cases of rabies in the dog, and made a number of rabbit inoculations from such cases with invariably positive results. Rabbits which I inoculated in the same manner from suspected but doubtful cases frequently remained perfectly well, showing that the mere operation will not bring on the symptoms of paralysis and death, and leading to a decision that the suspected cases were not rabies."

Dr. H. J. Detmers, Columbus, Ohio, formerly professor of veterinary medicine in Ohio State University: Has observed 4 very pronounced and unmistakable cases—3 dogs and 1 horse—since 1893.

The Health Department of Buffalo, N. Y.: In a recent outbreak, not yet entirely over, investigated, on complaint, 45 cases in dogs; in addition 74 cases of dumb rabies and 41 cases of furious rabies were brought to the pound. Inoculations were made early from the case of a stray dog that ran amuck at Evans, biting 17 dogs and 2 cats. The dogs inoculated developed typical rabies on the twenty-third day following.

Records of the county superintendent of poor and the city department of health show that 29 persons were sent to the Pasteur Institute at New York, 4 of these being bitten by rabid cats. Four persons died of the disease—the first, a child, eighty-one days after being bitten; the second, the owner of the dog which bit the child, who was sent to the Pasteur Institute at New York, dying there, the disease in him developing on the eighty-third day; third, a young man, bitten by strange dog which he was trying to throw out of a crowded dancing hall, and which was acting strangely; fourth, a woman, who died in October, 1899, having been bitten by a dog. A considerable number of animals other than dogs also died of the disease.

Dr. A. W. Bitting, veterinarian of the Agricultural Experiment Station of Indiana (writing under date of April 18, 1900), says:

"Your letter was received on the 10th, and upon the 11th we had a typical case of rabies in a dog at this station. This makes the third outbreak at this place. One outbreak occurred last August and September, in which 1 dog, 7 horses, and 8 head of cattle died. Part of these were brought to the experiment station laboratories. The first outbreak occurred some years ago, and some two or three dogs in the neighborhood and several sheep and hogs belonging to the station were affected. A number of outbreaks have been reported in the State. I have never seen a case of rabies in man, but our State board of health records 3 deaths from such a cause last year."

Dr. C. A. Cary, professor of veterinary science in Agricultural and Mechanical College of Alabama: Six cases have been brought to the college and many others have occurred in the vicinity; altogether 24 cases of rabies are recorded at the college.

Dr. J. W. Scheibler, State veterinarian, Memphis, Tenn.: Has seen about 20 cases of what he believed to be rabies.

Dr. George H. Bailey, State veterinarian, Portland, Me.: Has had 1 case in his private practice, and the Maine general hospital had 1 case in a young man several years ago.

Dr. A. W. Clement, State veterinarian, Baltimore, Md.: Has had about 30 cases brought to his attention officially.

Dr. Samuel S. Buckley, veterinarian at Maryland Agricultural Experiment Station, College Park, Md., says:

"We had, several years ago, an outbreak in this town, originating, as far as we know, in a collie. This animal, in the course of his depredations, bit 3 cows, a cat, a calf, and the farm superintendent and his son. All the animals developed the disease before being destroyed. The farmer and his son were treated by Dr. Gibier, of New York, and never suffered any trouble."

Dr. Cooper Curtice, State veterinarian of North Carolina: Although he has been in that State but about a year, he has noted 1 case there in the human subject.

Dr. W. H. Dalrymple, veterinarian, State University and Agricultural and Mechanical College, Baton Rouge, La.: Has seen 1 typical case of rabies in the horse and at least half a dozen cases in cattle. From an interview with Dr. J. W. Dupree, surgeon-general of the State and ex-president of the State Medical Association, he learned that the latter has had in his practice 3 typical cases in the human subject resulting from the bites of dogs. The dogs were not destroyed but kept under observation, and they died, showing typical symptoms of the disease.

Dr. F. A. Bolser, State veterinarian of Indiana: Three outbreaks of rabies in six years, affecting horses, mules, cattle, and hogs. Two young men were bitten, badly lacerated, and died in great agony.

Dr. H. P. Clute, State veterinarian of Wisconsin: Fourteen cases in dogs, sheep, cattle, and horses. A successful inoculation of rabies with virus taken from the brain of a calf and dog has just been made at the experimental station at Madison. The calf died, having been bitten by a sheep that was bitten by a dog. All of these animals died of rabies. Rabbits inoculated with virus from the brain of the dog on March 15 died of rabies on the eighteenth and nineteenth days after inoculation. Those inoculated with virus from the brain of the calf died of rabies on the twenty-first and twenty-second days after inoculation.

Dr. A. T. Neale, director of Delaware Agricultural Experiment Station: Has seen many cases of rabies during the last ten years. Horses, cows, and dogs have been the victims. Has no complete record of the number of cases. Specifies the following cases:

(1) A cow, seen before death, was killed two days later, and medulla and section of cord removed and taken to University of Pennsylvania, where rabbits were successfully inoculated. Ten days later these inoculated animals died of dumb rabies, This cow was one of three or four in the same herd which died with similar symptoms.

(2) Inoculation from a suspicious dog at experiment station on rabbit caused death by paralysis ten days later.

(3) A horse observed at 10 a. m. died after four or five hours; was undoubtedly affected with rabies. No inoculation test made.

Two or three dog cases have been demonstrated by Professor Chester and Dr. Robin at this station since last summer. In every instance rabbits have been the test animals, and in every case the rabid dogs have been under observation for several hours prior to death.

Dr. H. P. Eves, of Wilmington, Del., has many cases of cows and dogs in his practice, victims of this disease. Dr. J. J. Black, of Newcastle, has had human cases in his practice.

Dr. M. E. Knowles, State veterinarian of Montana: Has seen about 60 cases of rabies during a practice of fifteen years, of which 53 cases were brought to his attention officially.

Dr. J. W. Elliott, State veterinary surgeon of South Dakota: Has had as many as 100 cases brought to his notice officially in the last two years, mostly in cattle, and the origin could be traced to dogs afflicted with rabies.

Dr. G. T. Seabury, State veterinarian of Wyoming: Destroyed a dog affected with rabies in Cheyenne on March 30, and has seen 3 cases of the disease.

Dr. Sol. Bock, State veterinary surgeon of Colorado: Has seen at least 50 cases of rabies in the past year.

Dr. Paul Fischer, State veterinarian and professor of veterinary science and pathology of Kansas State Agricultural College: Reports a case of rabies in a horse in 1897. The animal was brought to the college and showed very characteristic symptoms. It had been bitten by a rabid dog three weeks before. The animal died on the following day. Intracranial inoculation of a rabbit with portion of cord of the horse produced death after thirty days from paralytic rabies.

Dr. A. T. Peters, animal pathologist at University of Nebraska: Reports about eight different outbreaks of rabies recorded there. In one outbreak a dog bit several other dogs, and also a cow and a horse. The cow, a fine Jersey heifer, was bitten in the nose. She was quarantined, and thirty-one days afterwards showed all the symptoms of rabies. The horse was bitten very slightly, and showed the disease some two hundred days later.

Dr. L. L. Lewis, professor of zoology and veterinary science at Oklahoma Agricultural and Mechanical College: Two cases of rabies have come under his observation since he has been in that position.

At this writing (December, 1900) information is received from Dr. George W. Coler, health officer of the city of Rochester, N. Y., of an extensive outbreak of rabies in that city and vicinity. Dr. Coler has officially reported to the mayor that since June 1 he has seen from 25 to 50 dogs with unmistakable evidences of rabies, a number of the animals having been shown to be rabid by inoculation experiments, which in 4 cases were verified by Prof. V. A. Moore, of Cornell University, and Dr. M. P. Ravenel, of the University of Pennsylvania. Upon the recommendation of the health officer, the mayor has issued a proclamation ordering "that, until further notice, the owners of dogs are prohibited from allowing them to run at large in any public street or place within the city of Rochester, unless such dogs be securely muzzled or led by a line or chain so as effectively to prevent them from biting any person or animal."

In a valuable article published in the St. Paul Medical Journal, October, 1900, Dr. F. F. Wesbrook, director of State board of health, bacteriological laboratory, and professor of pathology and bacteriology in the University of Minnesota, details investigations of specimens from suspected cases of rabies, from which he concludes:

> It is very evident that rabies does exist in this State and is fairly widespread in distribution and number of cases. The cases examined, and which proved to be rabies, include 1 human being, 20 dogs, 1 horse, 7 cattle, 1 pig, 1 sheep, and 1 wolf. We have histories which show that infection was known to be due in these cases to the bites of 19 different dogs, and perhaps 1 skunk, in which rabies infection may be assumed from the demonstration of rabies virus in the cases bitten by them. We have also data which show that at the time of the infection of the cases investigated by the laboratory 1 man, 8 dogs, 8 cattle, 6 swine, and 6 sheep were known to have been bitten, and of these, 8 cattle, 6 swine, 6 sheep, and 3 dogs died of rabies—that is, all of the cattle, swine, and sheep developed rabies. The man received Pasteur treatment.
>
> The animals which were thus shown to have had rabies on laboratory investigation are known to have bitten 7 human beings, 3 dogs, 6 cattle, 1 horse, and 5 hogs. Of these, 5 of the people received Pasteur treatment, and none, so far as is known, developed rabies. Of the animals bitten, 5 cattle, 1 horse, 1 hog, and 4 dogs developed rabies and died or were killed. Many more of the dogs known to have been bitten were killed before rabies had a chance to develop. As an example, it may be mentioned that in Willmar 30 were killed at one time. These estimates have been

carefully made, and where the information at hand stated that several animals had been bitten, account was taken only of one.[1]

It will, therefore, be seen that from these 46 cases examined, of which 31 were shown to be rabies, and concerning which there was data in only a small portion of the cases, we have been able to obtain positive knowledge of 84 cases of rabies in this State. (See table below.)

Items.	Human beings.	Horses.	Cattle.	Sheep.	Swine.	Dogs.	Wolves.	Total.
Rabies diagnosed by laboratory, Minnesota State board of health	1	1	6	1	1	20	1	31
Animals which bit the animals shown by the laboratory to have been rabid						19		19
Animals which developed rabies and died from bites inflicted under the same circumstances as those animals which were shown to have been rabid by laboratory investigation			8	6	6	3		23
Animals which developed rabies after having been bitten by animals shown by the laboratory to have been rabid		1	5		1	4		11
Total	1	2	19	7	8	46	1	84

In the Fifth Biennial Report of the West Virginia State Board of Agriculture for the years 1899 and 1900, Dr. S. E. Hershey, consulting veterinarian, states that quite a number of outbreaks of rabies have occurred within that State in the past few years, with considerable damage and loss of stock. He gives, as coming under his personal observation during the period covered by the report, 4 cases of cattle and 1 of a horse, 4 of which animals were known to have been bitten by dogs. In addition there were many similar cases in the same herds or on the same farms which he did not personally see. In Lewis County several horses died with rabies and several people were bitten. Some of the people were sent to the Pasteur Institute at New York for treatment. Several deaths occurred in the human family in that county.

The Biennial Report of the State Veterinary Sanitary Board and the State Veterinary Surgeon, of Colorado, for the years 1899 and 1900, contains this paragraph:

> Last year an epizootic of rabies occurred in this State, but the outbreaks in all cases have been vigorously handled by the local health authorities, and at the time of making report the epizootic may be considered to be effectually suppressed.

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[1] This statement apparently explains the inconsistency of some of the figures, and indicates that in some cases they are below the actual number.

In the vital statistics of the census of 1890, the deaths from hydrophobia in man are reported by States for the year ended May 31, 1890, as follows:

Alabama	7
Arkansas	4
California	1
Colorado	2
Connecticut	2
Florida	2
Georgia	16
Illinois	3
Indiana	4
Kansas	3
Kentucky	5
Louisiana	5
Massachusetts	21
Michigan	2
Minnesota	4
Mississippi	5
Missouri	11
Nebraska	2
New Hampshire	1
New Jersey	3
New Mexico	6
New York	5
North Carolina	3
Ohio	3
Pennsylvania	6
South Carolina	6
South Dakota	1
Tennessee	5
Texas	3
Virginia	2
Total	143

The results of the census of 1900 not being available, application was made to the health officers of the principal cities of the United States for the number of deaths from hydrophobia in man during the decade from 1890 to 1899, according to their official records. The reports received, to which have been added a few cases reported from unofficial but reliable sources, show that for the period named, and including in some instances the first half of the year 1900, there were in 73 cities 230 deaths from this disease after eliminating cases in which the diagnosis was reported as doubtful. The figures for some of the leading cities are as follows:

Greater New York	[1] 27
Chicago	68
Philadelphia	[2] 8
Baltimore	8
New Orleans	14
Buffalo	[3] 4
Pittsburg	7
Washington	5
Nashville	5

In a number of these cases the diagnoses were verified by inoculations of small animals with material from the human subjects.

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[1] Incomplete, as the records of some of the boroughs did not go back for the whole period.

[2] Only 6 of these cases are officially reported by the health department, and these are all prior to 1897. In one of the remaining cases inoculation experiments were made with positive results, and the other is well authenticated, though the coroner is reported as refusing to accept certificates of death from hydrophobia, and requiring that the certificates be made to ascribe the deaths to other diseases.

[3] All occurred in 1900. No report was received covering the period previous to this outbreak.

FACTS AND FALLACIES CONCERNING RABIES.

It required many years of patient scientific research to lead the ablest investigators to a clear comprehension of the cause, nature, and characteristics of rabies, and it is only recently that this has been accomplished. From the earliest dawn of history the disease has been feared and dreaded; its terrible manifestations have been surrounded with an atmosphere of awe and mystery, and it is not surprising that myths, fallacies, and misconceptions in regard to it have been common and widely accepted. Nor have such errors been confined to the ignorant or those unfamiliar with the subject of disease, but, on the contrary, they have been shared and propagated by men of learning, some of whom have stood high in the medical world.

As the investigations by which we have come to a tolerably clear understanding of the facts concerning rabies have been comparatively recent, and have appeared for the most part in scientific periodicals, fallacies in regard to the disease still have a strong hold upon the public mind, and are industriously circulated by many who believe they are working in the cause of truth and humanity. Persons in a position to know the facts have either not had the time, the disposition, or the opportunity to take up this subject and show its importance to the people and the desirability of educational work with a view to the control of the contagion. For years we have been living in fancied security from this disease; we have been told that it was extremely rare, if, indeed, it had any existence outside the imagination; and during these years the plague has spread, with only the feeblest efforts for its control, until now it has become so common as to be a positive and constant menace to our animals and to human life. The facts already presented demonstrate its frequency, but they do not give an adequate idea of the losses from it.

In many sections where it exists its nature is not recognized. Some outbreaks, in which most of the cases were of the dumb or mute form, were not recognized even by veterinarians. One such case, where 50 or 60 dogs were reported affected, was so characteristic in symptoms that its nature could not be doubted. The "dropping" of the jaw and the uniformly fatal results after a few days' illness attracted attention, but apparently did not excite suspicion. In the Rochester outbreak so many cases of dumb rabies occurred that the disease was popularly known as "drop jaw." Three animals so affected, the health officer states, were found in one load of dogs that was taken to the pound.

In order to convey a clear idea of the subject, some of the principal questions concerning rabies will be briefly considered *seriatim*.

THE REALITY OF RABIES.

The first point in regard to which the earnest inquirer seeks information is the reality of rabies. Is there a particular and well-defined disease which can be clearly determined and separated from all other diseases, and which conforms to the description that has become classical in our text-books and has been accepted for generations? In other words, do we know there is such a disease as rabies, and if so, how do we know it?

GENERAL RECOGNITION OF SUCH A DISEASE AS RABIES.

From the time of Aristotle (322 B. C.) till the present day we have clear accounts of this disease existing through every age, and provoking fear and horror in many countries. It was caused by the bite of an animal, and such animal was generally alleged to be rabid. It was almost invariably described as fatal in men and animals. The symptoms, from the earliest times, have been given as nervousness, excitability, restlessness, fear, irritability, great sensitiveness of the skin, paroxysms of fury, spasmodic contractions of certain muscles, paralysis, and death.

The medical profession, as a whole, has always recognized the existence of such a disease as rabies in man, and also that this disease is caused by the bite of a rabid animal. The veterinary profession has, from its foundation, recognized the existence and contagiousness of the disease. Its schools, from the earliest to the latest, have consistently taught this doctrine, and its text-books are all but unanimous on the subject. The same may be said of the text-books on human diseases. Would it not be extraordinary, not to say, incredible, if, at this late day, it were proved that the thousands and hundreds of thousands of observations recorded from the birth of history to the present day, by the trained physician or veterinarian as well as by the layman, were misconceptions, that the authors were deceived, and that the disease was a myth? Where can a parallel be found to such a sudden and complete overthrow of an ancient and almost universally accepted conclusion concerning a phenomenon so accessible to observation and investigation?

INSUFFICIENCY OF OBSERVATION TO PROVE THE DISEASE.

There have, however, apparently been a few persons in all ages who ve questioned the existence of rabies. The mysterious and unusual enomena were sufficient to explain this doubt on the part of thinkers d writers without personal experience with the disease, or who proached its study with preconceived opinions. Previous to the ineteenth century it was difficult to answer the objections of such critics. At the most, it could be affirmed that cases of a disease with h a train of symptoms had been observed, and that this disease followed the bite of a dog supposed to be rabid. It could not be proved that the dog which did the biting actually was rabid, or that the disease certainly resulted from the bite, or that the disease in the dog and the man were identical.

EXPERIMENTATION MARKS A NEW ERA IN THE MEDICAL WORLD.

With the beginning of the century came a new era in the medical world. The student of disease began to feel the necessity for a more substantial foundation for his knowledge than the ordinary observation of the accidental cases which from time to time occurred in his practice. These accidental cases were often too widely separated for comparative study, the conditions under which they developed could not be known or controlled, and the essential phenomena could not be determined. Observations made and conclusions reached under such circumstances were unreliable. Different observers would reach diametrically different opinions, and one apparently had as good evidence for his views as the other. The confusion and absurd hypotheses which resulted can only be realized by comparing the text-books of a century ago with those of the present day.

The doubts, errors, and confusion which arose in the attempt to study disease by the observation of accidental cases were finally dispelled by experimentation. What could be more rational, for example, in case there was a doubt as to the transmission of canine madness by biting, than to make an experiment by allowing a rabid dog to bite four or five other dogs and to keep an equal number unbitten for comparison? If the bitten dogs contracted rabies and the unbitten ones remained free, that would be presumptive evidence of transmission. Such an experiment, repeated perhaps a few times, with precautions against accidental infection, would afford positive demonstration as to this essential point in our knowledge of the disease.

DEMONSTRATION OF RABIES BY EXPERIMENTATION.

Zinke,[1] in 1804, announced that he had inoculated a dog, a rabbit, and a cock with saliva from a rabid dog, taking the saliva with a brush from the animal soon after its death and spreading it over superficial wounds of the inoculated animals. The dog was inoculated in an anterior limb, and showed prodromic symptoms on the eighth day, and was rabid on the ninth day. The rabbit was rabid on the eleventh and the cock on the fourteenth day.

This experiment, made so early in the century, proved (1) the virulence of the saliva of rabid dogs; (2) that the disease might be artificially inoculated; (3) that the disease might be communicated by inoculation to the dog, the rabbit, and the fowl; and (4) it disproved the old doctrine that the contagion disappeared at the instant of the animal's death (*morte la bête, mort la venin*).

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[1] Zinke, Gottfried: Neue Ansichten der Hundswuth, etc., Jena, 1804, S. 180. Quoted by A. Högyes: Lyssa, Wien, 1897, p. 32.

Count Salm-Reiferscheid, in 1813, recorded experiments in which several dogs were inoculated, part with fluid and part with dried saliva from a rabid dog. These were affected with rabies in eight to ten days. This experiment proved that the saliva remained virulent a considerable time after the dog's death, and that it would even withstand a certain amount of drying.

These two series of experiments give us the evidence of the existence of a specific, communicable disease of the dog, which is transmitted by inoculation with the saliva. There was still a question as to whether cattle and sheep—animals which do not naturally defend themselves or combat others by biting—developed virulent saliva when they contracted the disease. To determine this, Berndt, in 1822, inoculated four wethers with saliva from the mouth of an ox which had died of rabies. All of these sheep contracted rabies, the period between inoculation and the appearance of the first symptoms being twenty-two, twenty-five, twenty-six, and thirty-one days.[1]

In 1841-42 Professor Rey, of the Veterinary School of Lyons, France, inoculated from sheep to sheep, using the saliva and inserting by lancet punctures. Of 7 animals inoculated in this manner, 6 contracted the disease.[2]

Renault reported that from 1836 to 1860 he had inoculated or caused to be bitten 131 dogs in his experiments, and that 68 of these afterwards became affected with rabies. The period of incubation varied with these animals from ten days to one hundred and eighteen days, and with about 18 per cent it was sixty days or longer.[3] This report gave much information as to the proportion of inoculated dogs which contracted the disease and as to the period which may be expected to elapse between the inoculation and the appearance of the symptoms.

There were many persons, including physicians, who at the beginning of the century doubted the transmission of rabies to man. The medical doctrines at that time were unfavorable to the idea of contagion, and the inclination was to look upon rabies as a simple irritation of the central nervous system. These views were exploded by Magendie, who inoculated a dog under the skin of the frontal region with the saliva of a young man under treatment for rabies. This dog became rabid in about a month, and was allowed to bite 2 other dogs, which in turn became rabid after forty days.[4]

Earle, Hertwig, Renault, and others made similar inoculations from affected persons to rabbits, conveying the disease. It was also shown that children so young that they could not cause the disease by worry and dread were affected by the bites of rabid dogs in the same manner as adults.[1]

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[1] Journal der practischen Heilkunde. C. W. Hufeland, November, 1824, pp. 59-61.

[2] Rey: Expériences sur la Rage. Journal de Médecine de Lyon, December, 1842, p. 461.

[3] Comptes Rendus Acad. des Sciences, 1863, p. 72.

[4] F. Magendie: Journal de Physiologie Expérimentale, 1821, p. 42.

It was, consequently, demonstrated that rabies is communicable to man as well as to animals, and that the saliva becomes virulent with man, as it does with the lower animals.

The diagnosis of rabies has been called in question in all ages, and there have always been persons who have asked, How do you know that this particular animal or that this individual person is affected with rabies and not with some other disease of the nervous system? The answer of the investigator is: If inoculations from this animal or this person transmit the disease to the inoculated animals, then it is certain that the individual from which the inoculation was made was affected with the disease; that is to say, rabies can not be produced with the saliva of animals or men affected with noncontagious diseases, nor is there any other known contagious disease with similar characteristics which may be confounded with rabies. The inoculation or biological test is therefore an accurate and reliable test, and should be used in all cases of doubt. It is identical in principle with the biological tests of glanders, pleuropneumonia, foot-and-mouth disease, rinderpest, variola, and other contagious diseases of animals which have long been used and relied upon in case other methods of diagnosis fail.

The value of rabbits for making the biological test of rabies was pointed out by Galtier in 1879 and by Pasteur a few years later. The obstacles to this test in practice were (1) that the saliva generally contained various kinds of bacteria and might cause the death of the rabbits from septic infection, and (2) that the period of incubation might be long and uncertain when cutaneous or subcutaneous inoculations were made. The investigations of Pasteur (1881) showed the constant virulence of the brain and medulla, and that these organs, being protected from saprophytic germs, furnished a pure virus which might be used for biological tests. He also showed that the inoculations might be made upon the surface of the brain, in which case the disease was certainly transmitted, and the period of incubation was reduced to a minimum.

Of late years the methods of Pasteur have been widely adopted. There are still skeptics, however, who object to this test, on the ground that it is the irritation to the brain, caused by the inoculation, that produces the disease, and that there is no proof of contagion when the rabbits die of supposed rabies. These people forget, however, that it is always possible in case of doubt to make the inoculation in the skin or muscles, or even to use larger animals, such as horses, cattle, sheep, or dogs. Rabbits are only used because they are cheap and convenient. Brain inoculations are made because they are more certain in results and the disease appears sooner. The Pasteur method has been sufficiently confirmed by other methods, and its reliability clearly demonstrated.

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[1] Tardieu: Discussion sur la Rage. Bul. de l'acad. de Méd., 1863, p. 1152.

Successful experiments of this order—numerous, and made by competent men—are absolutely conclusive as to the existence of a disease of the dog communicable to human beings, to dogs, and to other animals by biting and by inoculation with the saliva. If this disease is not rabies, what is it? And if it is given some other name, do not the facts stand the same under one name as under another?

It is a mistake to say that the disease alleged to be rabies has not been defined with sufficient clearness for its identification. Consider for a moment the description: A disease affecting principally the nervous system, shown by nervousness, excitability, restlessness, irritability, paroxysms of fury, uncontrollable desire to bite all other animals, convulsions, paralysis, death; caused by the bite of an animal similarly affected; communicable by inoculation with the saliva; having a long period of incubation (three to six weeks); comparatively short course of disease (two to ten days); invariably fatal. Is not that picture clear enough for identification? With what other disease can it possibly be confused?

The reality of rabies has been demonstrated by crucial experiments, so often repeated that there is no longer any reason for doubt. It is a fact established with the same certainty as any other fact in science, and it can not be overthrown by hypothetical arguments or general denials based upon intuitive reasoning.

THE COMMUNICABILITY OF RABIES TO MAN.

Aristotle taught that rabies was fatal to dogs and to every other creature which they bite except mankind. This early mistake as to the immunity of man has been carefully handed down across the succeeding twenty-two centuries as though it were the most precious bit of knowledge, and is still repeated on every hand by the many who oppose measures for the prevention of the disease. There was some apparent support for this opinion in a number of facts connected with the disease. First, only a portion of the persons bitten by rabid dogs subsequently show symptoms of the disease; taking all the statistics available, not more than one individual in every six thus bitten is found to contract rabies even when no prophylactic treatment is administered. Second, there are other abnormal conditions of the nervous system in man which are accompanied by symptoms resembling more or less closely those ascribed to rabies. Third, some persons who have been bitten by dogs not rabid have by constant worry, anxiety, and fear of rabies induced a nervous, hysterical condition, with symptoms simulating somewhat those of the actual disease.

With these known facts as a basis, it is not surprising that a certain number of writers of limited experience and the habit of superficial observation should reach the conclusion that the view of Aristotle was correct, and that the disease was not transmissible to man. They argued that it was only the comparatively few nervous and excitable people among those bitten who afterwards presented symptoms of rabies, and that these few had brought on these symptoms themselves by worry and fear, being affected not with true rabies, but with lyssaphobia (fear of rabies), which is simply a nervous and hysterical condition.

This reasoning was quite plausible a century ago, but it received a definitive answer when Magendie and other investigators inoculated dogs and various other animals from human victims of the disease, reproducing it in typical form. These experiments proved most conclusively that man as well as the lower animals is subject to rabies, and that when so affected his saliva becomes virulent, and may be the means of communicating the malady.

At present, when it is desired to make a positive diagnosis in a case of suspected rabies, this is done by the inoculation of some animal, usually a rabbit. Objection has been made by some critics to results obtained by inoculation of small animals, on the ground that the symptoms of the disease with such animals are not sufficiently characteristic to warrant a positive conclusion. This objection has little weight, since the long period of incubation (fourteen to twenty-eight days), the sudden appearance of the symptoms, the paralysis, and the short course of the disease, ending in death, are not likely to be seen in any other disease. In case of doubt, it is always possible to inoculate a larger animal, such as a dog, calf, or sheep, and thus reach an incontestable decision. The results of rabbit inoculations have been confirmed so many times by the inoculation of other animals that there is no longer any reason to doubt the occurrence of rabies in mankind or the reliability of the diagnosis by the usual tests.

Numerous cases of rabies in the United States affecting the human subject have been reported from various parts of the country, and tests have been made by our most competent investigators. These tests show that the disease not only exists, but that it is far more common than has been generally admitted. The extensive outbreaks of the disease in dogs reported from Buffalo, Rochester, and Washington during the past year, and the numerous smaller outbreaks which have occurred in widely separated localities, are disquieting, and show the importance of more systematic repressive measures. A considerable number of persons, mostly children, have been bitten in these outbreaks, some of whom have died after the most intense suffering. Others have taken the Pasteur treatment, at great expense and inconvenience.

These are the facts in regard to the occurrence of rabies in man and animals in the United States. When the medical statistics of other countries are consulted, there is found in many of them the same conditions. In Austria, Belgium, France, Germany, and Russia the official reports show a large number of cases of rabies in dogs and other animals each year and a certain number in man. These are among the most enlightened countries of the world, where medical science has achieved its highest advancement, and where the theory of error on the part of the health authorities in regard to the nature of the disease is out of the question.

Such facts are met by the assertion that one prominent physician in Philadelphia has been endeavoring to find a case of rabies in man or in one of the lower animals for sixteen years without success; that another physician in New York has not been able to satisfy himself of the reality of the disease after many years of investigation; and that a neurologist in Washington, D. C., has publicly offered a reward of $100 for a case of rabies in man or dog. These assertions are plausible, and to those unacquainted with all the facts they may be convincing. In reality they are deceptive and misleading. There have been numerous cases of rabies in dogs brought to the veterinary department of the University of Pennsylvania every year for many years, and any physician in Philadelphia could make arrangement with that institution to see and study the cases if he so desired. In the same manner any reputable physician in New York could have arranged with one of the veterinary schools or with the board of health in that city for a similar opportunity. There have been also rather frequent reports in the medical journals of patients at the hospitals in that city affected with this disease, and in some cases inoculation tests have demonstrated the correctness of the diagnosis. How can it be possible that a prominent physician living there and presumably well acquainted with the members of his profession has diligently searched for years for such cases and failed to find any? As to the neurologist in Washington, D. C., the writer publicly answered his advertisement, and proposed to produce a case of rabies, the genuineness of the disease to be decided by a committee appointed by the Medical Society of the District of Columbia, and the reward, if earned, to go to a charitable purpose. The gentleman, however, did not accept the proposition, but withdrew his advertisement, and apparently had no further desire to see a case of the disease.

THE FREQUENCY OF RABIES.

Some idea of the frequency of rabies in the United States may be obtained from the facts which already have been given. The cases mentioned are, however, only a few of what have occurred in the country, since the inquiry which elicited them has been by no means extensive or exhaustive. It was, nevertheless, sufficient for the purpose, which was to show the wide distribution and comparatively frequent cases of the disease. It may be safely concluded that instead of being a much more rare disease than is generally supposed, it is a much more common disease than we had reason to expect.

In many other countries the disease is equally prevalent. The official reports of Germany show 1,202 cases of rabies in animals (mostly dogs) in 1898. In France there were 2,374 animals affected in 1899. In Belgium there were 444 cases. In Great Britain there were 727 cases in 1895, and in Hungary 1,397 cases in the same year.

It is frequently asserted as an argument against the existence of rabies, that it is unknown at Constantinople and in India, where dogs are common and unrestrained. But why go to distant countries, from which it is difficult or impossible to get accurate information, for arguments on this subject when the disease exists in our own cities, where it is accessible and may be investigated? If the condition of New York City, with its newspapers, board of health inspectors, veterinary schools, and highly intelligent population, is misrepresented, what may not be said of Turkey and India without fear of successful contradiction!

Whether rabies is or is not frequent in the Orient has little bearing on its existence here. What we know is that the disease is or has been common in all of the highly advanced and best-known countries of the world. Our investigations show that it is equally common in the United States. These facts can not be overturned by the citation of reports from other countries, even if the accuracy of such reports were satisfactorily established. The frequency of rabies in the United States can only be determined by careful scientific investigations here, and not by reports from elsewhere. The cases cited from European countries have been produced simply to show that the disease was common there as well as here, that it is recognized by scientific authorities and by the leading governments, and that, consequently, the statement sometimes made to the effect that the highest authorities in the world deny the existence of rabies is incorrect and without foundation in fact.

THE EFFECT OF SEASONS UPON THE DEVELOPMENT OF RABIES.

Homer is supposed to refer to rabies when he mentions the dog star, or Orion's dog, as exerting a malignant influence upon the health of mankind. This ancient belief has come down to our times, many intelligent people still holding that it is principally during the dog days that rabies develop, and that the disease can not exist during the cold months of the year. The scientific study of the disease and the statistical records show, however, that rabies is prevalent in winter as well as in summer, and that if the season has any influence upon its development this influence is not very marked.

Bouley[1] compiled statistics showing 755 cases in December, January, and February; 857 in March, April, and May; 788 in June, July, and August; and 696 in September, October, and November. At the Alfort Veterinary School for the years 1887, 1888, 1889, and 1890 the cases were as follows: January, February, and March, 130; April, May, and June, 60; July, August, and September, 50; October, November, and December, 74.

The following table, giving a large number of cases by months, has been compiled from statistics at hand:

Cases of rabies in dogs, by months.

Source.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Bourrel [a]	36	31	26	32	32	42	32	30	35	41	24	32	393
Saint Cyr [b]	12	15	6	15	13	7	4	9	1	3	......	2	87
Högyes [e]	309	310	314	367	450	502	580	537	455	438	303	396	4,961
Leblanc [d]	103	97	121	192	155	138	147	123	104	117	95	100	1,492
France: [c]													
1895	89	155	153	184	181	129	157	147	133	110	105	149	1,692
1896	124	138	151	150	147	199	138	117	131	125	103	164	1,687
1897	131	151	189	202	225	172	192	154	136	131	150	140	1,973
1898	139	148	......	181	216	278	185	177	150	......	153	154	1,781
Total	943	1,045	960	1,323	1,419	1,467	1,435	1,294	1,145	965	933	1,137	14,066

[a] Fleming: Rabies and Hydrophobia, London, 1872, p. 96.
[b] Loc. cit., p. 97.
[c] Högyes: Lyssa, Wien, 1897, p. 25.
[d] Leblanc: Statistique de la rage, Bul. de l'acad. de med., 1880, pp. 960-963.
[e] Official statistics.

These statistics are very interesting, and effectually dispose of the fallacy that rabies can not occur in the winter. The compilation of Bouley shows 755 rabid dogs in December, January, and February, and 788 in June, July, and August—a very slight difference, and one which is probably without significance. The records of the Alfort Veterinary School are of especial value, because the diagnosis was made by the most skillful experts in the world. These show two and one-half times as many cases in January, February, and March as in July, August, and September. Taking the compilation of 14,066 cases by months, it is found that June stands highest, with 1,467 cases, or about 25 per cent more than the average. July is second, with 22.4 per cent over the average. May is third, with 21 per cent over the average. It would appear, therefore, that the most cases of rabies occur during May, June, and July, which are not usually the hottest months of the year. If the heat has any considerable effect in the development of rabies we should expect August to show the largest number of cases; but, as will be seen by the table, it stands fifth in the list of months, with only 10.4 per cent more than the average, being below April, which has 12.8 above the average.

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[1] Dict. de Méd. de chir. et d'hyg. vet. Zundel, Paris, 1877, p. 348.

The fewest cases occurred in November, which month had 20.4 per cent less than the average; January had 19.5 per cent less than the average; March was 18 per cent below the average. As if to emphasize the uncertainty of predicting the distribution of rabies by seasons, according to the average temperature, February stands but 10.8 per cent below the average number of cases and December but 3 per cent below.

In a general way, it may be provisionally admitted that more rabies occurs in dogs in the months from April to September, inclusive, than from October to March; but the disease is seen in every month of the year, and as June stands highest, with 1,467 cases, and November lowest, with 933 cases, the difference is not sufficient to warrant any one in deciding that a suspected animal is not affected with rabies because the symptoms are observed in one of the winter months.

THE SYMPTOMS OF RABIES.

The symptoms of rabies are such as we should expect from serious disease of the central organs of the nervous system: First, irritation; second, paralysis and death. The rabies virus appears to have little effect upon the system until it reaches the brain and spinal cord. There it multiplies, sets up irritation, and finally interrupts the functions.

Rabies is generally divided into two forms: First, furious rabies; second, dumb rabies. In the former the animal is irritable, aggressive, and bites nearly every object which comes in its way; in the latter the muscles of its jaw are paralyzed almost from the first appearance of symptoms, and being unable to bite, the animal remains more quiet and tranquil. Essentially the two forms of the disease are the same, but owing to the parts of the brain attacked and the acuteness of the attack, paralysis appears much sooner in one of these forms than in the other. The saliva from a case of dumb rabies is just as dangerous and virulent as that from a case of furious rabies. The dogs with dumb rabies are less dangerous simply because they are unable to bite and thus insert their saliva into a wound.

The impression should not be formed that dumb rabies and furious rabies always represent two distinct types of disease, and that one may at a glance classify every case as belonging to one or the other of these types. Quite the contrary. The typical cases belong to the two extremes of symptoms, and there are all gradations between the two. In fact, almost every case of furious rabies sooner or later changes into the dumb form, that is, the final stage of rabies is almost invariably paralytic, and the dumb form in its typical development occurs when the paralysis appears on the first day of the disease. The paralysis may not appear, however, until the second, or third, or some subsequent day.

Again, a dog does not necessarily bite everything about it even though it has rabies and its jaws are not paralyzed. It may be combative and furious all of the time, or only a part of the time, or not at all. There is no disease in which the symptoms vary more than in rabies of the dog, and it is, consequently, impossible in any description of moderate length to give an idea of the different forms under which it may appear.

FURIOUS RABIES.

Fleming has well said that it is a great and dangerous error to suppose that the disease commences with signs of raging madness, and that the earliest phase of the malady is ushered in with fury and destruction. The symptoms appear very gradually, and at first there is only the slightest evidence of brain disease. The animal's habits and behavior are changed. It may be more restless and affectionate than usual, seeking to be near its master or mistress, fawning, licking the hands or face, and apparently seeking for sympathy or assistance. Such caresses are, however, extremely dangerous, for the animal's tongue, moist with virulent saliva, coming in contact with a part where the skin is thin, abraded, or wounded, may fatally infect the person for whom it is endeavoring to demonstrate its affection. The smallest abrasion may be, as Bouley has impressively said, a door opened to death; and such a death! The instances in which hydrophobia has developed from such inoculations are very numerous, and everyone should be warned against this kiss of affection, which carries with it not only death, but sufferings which are far more to be dreaded than the fatal termination.

In most cases dogs first become dull, gloomy, morose, taciturn, seeking solitude and isolation in out-of-the-way places, or retiring under pieces of furniture. But in this retirement they can not rest; they are uneasy and agitated; they lie down and assume the attitude of repose, but in a few minutes are up again walking hither and thither, "seeking rest, but finding none." Occasionally this restlessness may disappear for a time, and the animal become lively and affectionate; oftener it sinks into a sullen gloominess, from which even its master's voice rouses it but temporarily. It becomes more and more desperate in its efforts to prepare a comfortable bed, pawing or scattering the straw, or, if in a house, scratching, tumbling, and tearing cushions, rugs, curtains, carpets, and everything of that kind within its reach.

At this period dogs may have aberrations of the senses, of the sight, hearing, and feeling, which cause hallucinations, and lead them to think that they are being annoyed by something, or that some animal or person is endeavoring to injure them. They crouch, ready to spring upon an enemy; they rush forward and snap at the air; they throw themselves, howling and furious, against a wall, as though they heard sounds beyond it.

While at first the affected dog may not be disposed to bite, it becomes more dangerous as his hallucinations and delirium increase. The voice of the master or of an acquaintance may dispel the aberrations temporarily and lead him to friendly demonstrations, but an unexpected movement or touch may bring on another access and lead to a quick and unexpected bite.

The disturbance of the sensations leads to chills and itching. If the place where the bite occurred is accessible the dog licks the scar, and later bites and tears the tissues. This tearing of the flesh is not always confined to the site of the inoculation, but certain regions of the body appear to lose their sensitiveness, and at the same time to convey to the brain the sensation of itching. The animal in this case bites into its own flesh with apparent pleasure and satisfaction.

Such animals take food until the disease is considerably advanced, if it is something which can be swallowed without mastication; otherwise it is dropped after remaining a short time in the mouth.

Difficulty of swallowing is an early symptom, and frequently leads the unsuspecting owner to conclude that the animal has *a bone in his throat*. A dog which appears to have a bone in his throat is on general principles one of the most dangerous animals in existence. The supposed bone may be there, but on the other hand the symptoms which lead to this supposition may be due to partial paralysis caused by rabies, and the owner may be inoculated with the virulent saliva while thrusting his finger or hand in the dog's mouth to discover a bone which has no existence but in his imagination.

It is commonly believed that mad dogs have fear of water and are unable to drink, but there could be no greater mistake. In this respect they differ entirely from the human patient. They have no fear or dread of water, but continue to drink until paralysis has progressed so far that they are no longer able to swallow. The fact that a suspected dog is seen to drink or to wade into a stream is consequently no evidence that he is not mad.

When the furious symptoms come on, the dog leaves his home and goes upon a long chase, with no apparent object in view other than to be traveling onward. He trots at a rapid pace, eye haggard, tail depressed, indifferent to his surroundings. He flies at and bites dogs and persons whom he meets, but usually does not apparently search for them, or even notice them if they remain quiet. Dogs in this condition may travel many miles, and finally drop from exhaustion and die. Often after an absence of a day or two they return to their home, exhausted, emaciated, covered with dust and blood, and presenting a most forlorn and miserable appearance. Those who have pity for such an animal, and try to make it clean and comfortable, are in great danger of being bitten, for the disease has advanced to a point where the delirium or insanity is most marked, and where a treacherous bite is most common. Doubtless the dog has no intention of injuring a friend, and would not do so did he not see that friend transformed by his disordered vision into some distorted and unrecognizable shape, which he thinks is about to injure him. But while we may give the dog due credit for not intentionally and deliberately inoculating his friends with this fatal virus, let us not forget that the inoculation is no less deadly because it is the result of the abnormal working of a disordered mind. Whatever the sentiment may be which leads the dog to turn upon his master or mistress and inflict an injury, the duty remains the same for the owner to take due precautions to prevent such an occurrence.

If the animal, instead of being allowed to escape, is kept confined, the paroxysms of fury are seen to occur intermittently, or, in the absence of provocation, they may be entirely wanting. If excited, it howls, rushes upon objects that are thrust toward it, or throws itself against the bars of its cage and bites with great fury.

As death approaches, the animal becomes exhausted and scarcely able to stand; the eyes are dull and sunken, and the expression is that of pain and despair. Paralysis appears in the jaws or in the posterior extremities, and extends rapidly to other parts of the body. The animal, being unable to stand, lies extended upon its side; the respiration becomes more and more difficult; there are spasmodic contractions of certain groups of muscles, complete prostration, and death.

The ordinary course of the disease is four or five days; it may be as short as two or as long as ten days.

DUMB RABIES.

When this form of the disease is typical, it comes on with restlessness, depression, a tendency to lick objects, and paralysis of the muscles, which close the jaws. As a consequence of the paralysis, the lower jaw drops, the animal is unable to close the mouth, the tongue hangs out, and an abundance of saliva escapes. The mucous membrane of the mouth becomes dry, discolored, and covered with dust. The animal remains quiet, does not respond to provocations, and appears to understand its helplessness. As Bouley has said, the animal can not bite and does not desire to bite.

When dumb rabies follows a period in which the animal has been affected with the furious form, the desire and tendency to bite may be retained even after the jaw is paralyzed.

The course of the disease is short, death usually occurring in from two to four days.

The dumb form of rabies is very common, and many persons know it as "drop jaw" who have no idea of its true nature.

Many of the common mistakes with reference to rabies arise from an imperfect knowledge of the symptoms. It is on this point that there is greatest need of educational work. Bouley has most earnestly warned us to "distrust a dog when it shows signs of illness; every sick dog should as a rule be suspected; more particularly distrust a dog when it becomes dull, morose, and seeks for solitude, which appears not to know where to rest, which is always on the move, prowling, snapping at the air, and suddenly barking at nothing when all around is perfectly still, whose countenance is somber, and only assumes its usual animated expression by brief starts; beware of the dog that seeks and scrapes incessantly, and exhibits aggressive movements against phantoms; and, finally, beware, above all, of the dog which has become too fond of you, and is continually endeavoring to lick the hands or face."[1] The writer would add to this warning the injunction to beware of the dog which appears to have a bone in his throat, and, further, beware of this animal when he has wandered from home and returns covered with dirt, exhausted and miserable.[2]

THE PERIOD OF INCUBATION OF RABIES.

The period of incubation of a contagious disease is the time which elapses between the inoculation or exposure and the appearance of the first symptoms. With rabies this period varies remarkably. It may be as short as six or seven days, and it occasionally exceeds one hundred days. In rare cases, it has been reported on good authority that a year, or even fourteen months, elapsed between the time the animal was bitten and the time when the disease manifested itself. The majority of cases develop in from three to seven weeks.

During the greater part of the period of incubation the infected animal is healthy, and would not cause disease in any animal or person which it bites. The saliva may become virulent, however, two or three days before the appearance of the first symptoms, and any animal or person bitten after the contagion has contaminated the saliva is, of course, liable to contract the disease.

There is a very erroneous and rather stupid belief, quite common, to the effect that if a dog bites a person and becomes mad at any time thereafter the person so bitten will contract hydrophobia. This fallacy may have arisen from some instance in which a person had been bitten within a few days of the appearance of the symptoms of disease in the dog, and when the saliva was already virulent. However this may be, it is perfectly certain that a dog can not convey this disease when he does not have it, or before he has himself contracted it. If, therefore, a dog does not show symptoms of rabies within a week from the time the bite is inflicted there is no danger of the person contracting the disease. The only possibility of an exception to this rule is the very doubtful one, that in extremely rare instances a dog may have rabies and recover from it without showing characteristic symptoms. A very few cases of this kind have been observed among dogs artificially inoculated, but it has not been shown that their saliva became virulent, or that similar cases occur under natural conditions. The fact remains, however, that a person is in no danger of contracting rabies because a healthy dog has bitten him, which dog is afterwards inoculated with rabies.

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[1] Fleming: Rabies and Hydrophobia, London, 1872, p. 197.

[2] In this description of rabies the writer has used as a basis the classical works of Bouley, Fleming, and Nocard and Leclainche.

The virus of this disease has been surrounded with so much mystery, and so many ridiculous opinions have been disseminated concerning it, that it is often looked upon with great awe and fear, as possessing either supernatural properties or at least being altogether different from anything else which has been known and investigated by scientific men. This is in no sense true, for while the rabies virus is peculiar to the disease and distinct from all other contagions and poisons, it is nevertheless subject to the same natural laws. If a person has sat in a crowded street car by the side of another person who some months afterwards contracts smallpox, the former would have no fear of the disease because he had been exposed to the latter before infection had occurred. On the same principle, no one would feel concerned because he had drank pure water from a clean cup, which cup was afterwards used as a receptacle for poisons. These illustrations are strictly germane to the subject, and should be sufficient to show the impossibility of the theory under consideration.

The extremely long period of incubation of rabies in certain cases is a fact which has been incontestably established.

Peuch has compiled a table of 144 cases of rabies in the dog in which the date of inoculation and the appearance of the first symptoms were definitely ascertained. These cases were observed by Renault, Leblanc, Saint-Cyr, and Peuch. This table is so instructive that it is reproduced from the Nouveau Dictionnaire de Médecine, de Chirurgie et d'Hygiène Vétérinaire, and the writer has added a column of percentages.

Incubation of rabies in the dog.

Number of days of incubation.	Number of cases.	Per cent.	Number of days of incubation.	Number of cases.	Per cent.
5 to 10	3	2.08	55 to 60	2	1.39
10 to 15	8	5.55	60 to 65	7	4.86
15 to 20	13	9.03	65 to 70	1	.69
20 to 25	25	17.36	70 to 75	5	3.47
25 to 30	13	9.03	80 to 90	7	4.86
30 to 35	25	17.36	100 to 120	4	2.78
35 to 40	6	4.17	365	1	.69
40 to 45	11	7.64	Total	144	....
45 to 50	9	6.25			
50 to 55	4	2.78			

Haubner mentions a case in which fourteen months elapsed after the bite before the disease developed. It is plain, therefore, that the rabies virus may retain its vitality and activity for a long time after it is deposited in the flesh of the animal body. How it can remain in the animal this length of time before it causes the disease is probably explained by the fact that it must reach the brain and spinal cord and multiply there before the disease develops. Now, the rabies virus is not able to penetrate through the body with the facility of many other forms of contagion; on the contrary, it appears necessary for it to be lodged in the circulating blood through a wounded vessel or to be deposited within the sheath of a nerve. If placed in the connective tissue beneath the skin in such manner as to avoid blood vessels and nerves it does not cause disease. In the cases of long incubation the virus has had difficulty in reaching the central organs of the nervous system.

Admitting, as we must, that a year may elapse between inoculation and the appearance of the disease, we must also accept the still rarer cases of fourteen months' incubation as not improbable. How absurd it is, therefore, to consider a bitten dog as safe after it has been quarantined for three or four weeks, as is the usual custom. Of the 144 cases carefully observed and brought together in the above table, 82, or 57 per cent, failed to develop the disease until after thirty days. A period of more than five weeks was required by 39.5 per cent of the animals, and 21.5 per cent showed no symptoms for seven weeks after being bitten. How long, then, should a dog that has been bitten by a rabid animal be quarantined before it is safe to mingle with the family and with other persons and animals? Is three months sufficient? Evidently not, for 3.47 per cent of this lot of dogs developed the disease after more than ninety days had passed. For absolute safety, every dog bitten by a rabid animal should be destroyed. For comparative safety a quarantine of one year is required.

DOES RABIES ORIGINATE SPONTANEOUSLY?

Most of the older writers on rabies, those whose writings appeared before 1865, admitted that the disease might develop spontaneously in the bodies of certain animals as a result of certain conditions of life and atmospheric influences. These same writers believed that most other contagious diseases frequently originated in the same manner. It was a time when the spontaneous generation of many living things was freely admitted, and when the ignorance of the nature of all kinds of contagion, with the exception of the larger animal parasites, was complete and impenetrable. Science had not yet definitely passed upon the doctrine of the spontaneous and continuous generation of living matter.

It was not a very long time before this when it was believed that the mite which causes scabies or itch was continuously developed spontaneously, and that it was folly for people to try to protect themselves from this disease. About the same time, or possibly a little earlier, it was thought that lice were spontaneously developed, and that both the domesticated animals and mankind were doomed to suffer from them for all time. Still earlier there was a common belief that crocodiles and other animal life developed spontaneously from the mud of the rivers and lakes in which they were found.

The study of natural history and the progress of science disproved one by one these ancient beliefs, and made it clear that all animals developed from preexisting animals of the same kind. Even lice and the mites of scabies were found to be subject to this invariable law of nature, and the eradication of such pests was taken up with energy and perseverance. The rarity with which these parasitic pests are encountered among civilized people of the present day proves the value of correct views upon such questions.

The last point to be yielded by the believers in spontaneous generation was the origin of the protozoa and bacteria—microscopic animals and plants so small that their life history could be studied only with great difficulty. It was finally shown, however, that even these infinitely small organisms obeyed the general law of nature and propagated and developed from ancestors, each species after its kind, and that in the absence of ancestors not even these low forms of life could appear.

About this time it began to be suspected that the cause of the contagious fevers was microscopic organisms, which were able to live a parasitic life in the bodies of men and the larger animals. After many observations pointing in that direction it was finally demonstrated in 1876 that the cause of anthrax was a bacillus, and shortly afterwards that fowl cholera, septicemia, hog cholera, tetanus, blackleg, tuberculosis, and various other diseases were due to similar microscopic vegetable organisms, each disease being caused by its own distinct species of germs. It was also shown that malaria, Texas fever, and some other diseases were caused by microscopic animal organisms belonging to the protozoa, and that here again each disease had its own definite and distinct species. In every case the minute plant or animal parasite had its own definite form and certain biological characters by which it might be distinguished from all other living things. Each species multiplies and propagates its kind, and there is no more evidence here than elsewhere in nature to sustain the doctrine of the spontaneous appearance of living things.

The first effect of these scientific demonstrations was to clear away a vast amount of rubbish which had accumulated in the standard teachings as to the cause of contagious diseases. If, for example, anthrax is caused by the *Bacillus anthracis* gaining entrance to the interior of the body and multiplying there, and if the disease can not be produced in the absence of this bacillus, then it becomes plain that the disease is not caused by electrical disturbances of the atmosphere, by too much food or too little food, by forage containing too much water or that which is too dry, by intense heat of summers or extreme cold of winters, or indeed by any of the other influences to which the development of the disease had been usually attributed. It was contact with substances containing the bacillus which produced the disease, and when this bacillus gained access to the animal body the disease developed without reference to the atmospheric conditions, the food, or the other elements of the environment.

The comprehension of this fact led Bouley and other great pathologists to revise their opinions regarding the origin of many contagious diseases. It had been held that glanders originated spontaneously from overwork and insufficient food; that bovine pleuropneumonia developed as a result of exposure of cattle in the mountains of Europe to extremely low temperatures; that cattle plague arose spontaneously in eastern Europe, and particularly on the steppes of Russia, and that rabies in the dog resulted from unfavorable conditions of life. The demonstration of the germ theory of contagion, which was quite unexpected by the majority of medical men, completely overturned these old views, based upon an entirely different hypothesis. The idea of spontaneous development, of origin *de novo*, was generally abandoned, and the further scientific researches have been pushed the more incontestable does it appear that the one and only factor of consequence in the production of these diseases is the entrance of the disease germ into the interior of the animal body, where it can multiply and disseminate itself.

If proper measures are taken to protect animals from the bacilli of anthrax, of glanders, of pleuropneumonia, they do not contract these diseases. Investigation of cattle plague in central Europe indicated that the disease always came from the East. Investigations on the steppes of Russia showed that it did not originate there, but came from the plains of Asia. Investigations in Asia indicate that even there the disease is always the result of contagion from some other affected animal. In the same manner, investigations of rabies failed to bring out any evidence to indicate that the disease might originate in any way except by contagion, that is, by inoculation from an affected animal. It may, therefore, be accepted as practically certain that rabies does not develop spontaneously in any animal, but that it is always the result of inoculation from some other affected animal.

If the doctrine of spontaneous generation, or abiogenesis, has been abandoned by scientific men, it has by no means lost caste with many persons who consider themselves philosophers; and these persons hesitate to accept or indeed bitterly contest the conclusion of science, which has been outlined above. If, they ask, every dog with rabies contracted the disease from some other dog affected with it, how did the first dog get it? This is a question, as to the origin of things, which we may with equal reason ask in regard to all living organisms. If every dog is brought into the world by the sexual union of two other dogs, where did the first dog come from? This question is just as difficult, but no more difficult than the other. Because we have in our question implied the philosophical absurdity of a series of dogs without a beginning, we have not convinced anyone that dogs can originate in any manner except by ancestors of their own species; nor is the similar question as to the origin of the first case of rabies any better reason for accepting the theory of the spontaneous origin at the present day of this disease.

There are many diseases of which it may be said that in our time and in our country they arise only by contagion. Prominent among these are smallpox, scarlet fever, measles, cholera, tuberculosis, glanders, bovine pleuropneumonia, foot-and-mouth disease, and rabies. Recorded history does not tell us where and under what circumstances the first case of any of these diseases appeared, any more than it tells us where and under what circumstances the first dog appeared. We know by observation, and by observation alone, how dogs are propagated at the present day, and we accept observation as conclusive upon this point. Why should we not accept observation and experimentation as conclusive in regard to the propagation of a contagious disease?

While we can not reasonably expect at this late day to decide the cause of contagious diseases by speculation as to the first appearance among animals of such diseases, it is legitimate to make such an inquiry in order to obtain a better understanding of these plagues. Science has made great progress in explaining the origin of species, and even in tracing in general terms the development of life upon earth; and while it can not say definitely where, when, and how the dog originated, it has been made plain that in some prehistoric age the dog developed from some earlier and related animal form, not by a sudden transformation, but by gradual transition. And in the same manner this early ancestor of the dog developed from a still earlier ancestor, doubtless quite different from the dog as he is to-day. To be brief, in tracing the development of the dog, we should be obliged to go back, step by step, toward the dawn of creation, toward simpler and simpler forms of life, until the primordial germ is reached. Just where in this long series of succeeding forms or just when in the countless ages that have elapsed since the beginning of the series the disease known as rabies appeared it is impossible to say. It may have been in comparatively recent times, and when the dog had arrived at substantially its present form and development, or it may have been in some previous geologic age, when the conditions of environment upon all parts of the earth were far different from what they are at the present day.

It is not to be supposed that the strange animals whose fossil remains prove their existence many thousands of years ago were free from contagious diseases any more than are the animals which live to-day; but whether the diseases of the prehistoric animal species were propagated from animal to animal until our time, or whether they disappeared and were replaced by more recent plagues, it is now impossible to say.

A study of the communicable diseases indicates that most if not all of them are caused by parasitic organisms. Indeed, the animal body has become the host of a multitude of parasites, most astonishing because of the number of species and the great variety of forms. All of these parasites probably at one time in the existence of their species, or of the ancestors of their species, lived elsewhere in nature. Under certain conditions they were attracted to certain kinds of animals; they found they could live upon or within them; they adapted themselves to these new conditions; their form and their physiological requirements were gradually changed, until finally in the course of time they could not exist elsewhere. They were then strictly parasitic.

So far has this development and adaptation to the conditions of environment gone that we find different species and varieties of lice, of mites, and of worms living upon each different species of animals, and in most cases these parasites perish if transferred from one species of animals to another species. If, therefore, these parasites can not exist when transferred to a different species of animals from that upon which they have developed and to which they have become adapted, there is all the more reason why they can not exist in nature elsewhere than upon or within the animal body. Hence, we find animal species living as parasites upon other animals, and having no individuals of their species living a nonparasitic existence. They have developed and have been modified since they began their existence as parasites, just as the species of animals living free in nature have been modified. Consequently, if an animal becomes infected with lice or mites at the present day it must get them from some other animal which bears them.

The adaptation and modification of the bacteria and protozoa which cause the contagious diseases has probably occurred in much the same manner as that of the larger animal parasites which we have been considering. The glanders bacillus has lived a parasitic existence in the bodies of animals of the horse kind for many thousands of years. It is no longer able to multiply or live for any considerable time in nature outside of the animal body. It is therefore a strictly parasitic organism. The bacillus of tuberculosis is even further developed as a parasite than the bacillus of glanders, as it is much more difficult to cultivate in the laboratory even under the most carefully adjusted conditions. There is no reason to suppose that any bacilli exist in nature having the same biological characteristics as have the glanders and tuberculosis bacilli.

The exact form of the rabies virus has never been satisfactorily determined, but what we know of it leads to the conclusion that it is a parasitic organism of some kind, which has been modified by thousands of years of existence within the animal body, and which has no counterpart elsewhere in nature. Inoculation with it is easy; it has specialized as to the conditions of life to such an extent that it multiplies only in the brain, spinal cord, nerve trunks, and a few glands; it can not be made to grow outside of the body by any methods now known. All of these facts indicate an obligatory parasitic existence. When or under what conditions in the prehistoric ages of the past it first became parasitic can never be known, nor can we determine at this late day how long a time was required to transform it from an organism which was only occasionally or accidentally parasitic into one which could live no other than a parasitic life. What appears certain is that for more than two thousand years rabies has been the same disease it is to-day; that it has been propagated by the same species of animals, manifested itself by the same symptoms, and produced the same fatal results.

It is not unlikely that other microscopic organisms will from time to time take up their habitat in the animal body and become obligatory parasites. There are a number of different bacilli now known which are capable of living in the flesh and causing fatal disease, but which only do this under accidental conditions. Among these are the anthrax bacillus, the bacillus of blackleg, the bacillus of malignant edema, and the bacillus of tetanus, all of which are deadly in their effects on animals inoculated with them, but all of which lack some quality required for their rapid dissemination or for the ready infection of susceptible animals. Consequently, they do not usually spread from animal to animal. With slight modification the anthrax bacillus might become the most terrible of the known disease germs. But that such modifications require time and conditions not often found, is proved by the fact that though this disease has been known since the beginning of medical knowledge, the bacillus has in the memory of man made no progress as a disease-producing organism, but on the contrary appears less capable to-day of gaining entrance to the tissues than it was two or three centuries ago.

THE PREVENTION OF RABIES.

It is unfortunate and inconsistent that those who pretend to love dogs most and to be most anxious for their welfare should be the ones who place the greatest obstacles in the way of attempts to control this disease. Of all animals, the dog is most often the victim of rabies, and he suffers not only from the disease, but from the reputation of propagating it. And to make the matter worse, he is still falsely accused of being a party to the spontaneous generation of the contagion. His true friends should come to the rescue and relieve him of this incubus which he has borne so long.

There is no contagious disease more easily eradicated than rabies. As the disease can only arise from contagion, and as the contagion is practically always transferred by a bite, and as the animals which do the biting are almost always dogs, it suffices to stop the dogs from biting for a period sufficient to cover the incubatory stage of the disease, that is, for about a year, in order to stamp out the malady. As a scientific problem, therefore, the eradication of rabies is a very simple matter, but as a practical question it is one of the most difficult which confronts the sanitarian. And this difficulty arises not from anything inherent in the work to be accomplished, but in the opposition of those who own and keep dogs. The measures necessary for the eradication of rabies are two in number: (1) Destruction of worthless, ownerless, and vagrant dogs; (2) efficient muzzling of all dogs which appear upon the streets or in public places.

The dog tax and license are efficient means of securing the destruction of worthless dogs, and if these are combined with the requirement that every licensed dog shall wear a metal tag of special form, the ownerless and vagrant dogs may be at once recognized and captured. As more than half of the dogs in the country are worthless or ownerless, this measure at once reduces very largely the canine population, and correspondingly lessens the material upon which the disease can work, as well as the chances of infection.

An efficient muzzle prevents dogs from biting, and, therefore, prevents the propagation of rabies. Muzzling is for this reason the most effective measure with which to combat the disease. Public sentiment in this country is generally against muzzling, and this measure is either not adopted or it is so imperfectly enforced as to have no other effect than to irritate the supersensitive dog owners. In Germany and Great Britain muzzling has had an immediate and most marked effect in eradicating the contagion.

The effect of these measures depends entirely upon the energy and thoroughness with which they are enforced. There should be a dog-catching force adequate to the work, whose duty it should be to seize all dogs found in public places without tags and all dogs wearing inefficient muzzles, and if these animals are not redeemed within a specified time to destroy them. Usually the requirements for tags and muzzles are evaded by a large number of dog owners, and it is common to see on the streets of cities, where they are supposed to be in force, numerous dogs without tags, and even a greater number with muzzles that are of no value as a means of preventing the animal from biting. This is due to the fact that there is seldom a sufficient force of dog catchers, and that the sympathy of the community is with those who violate the law rather than with those who endeavor to enforce it.

When there is an unusual prevalence of rabies among dogs, or when, unfortunately, some person contracts the disease, particularly if that person happens to be well known or prominent in the community, there may be a temporary exhibition of strict and energetic enforcement of the regulations. But as soon as the public alarm subsides the efforts are relaxed, the dog catcher disappears, the dogs are seen upon the streets with or without tags and muzzles, and all things go on as before the panic occurred. While the number of dogs is thus periodically reduced somewhat, it is seldom that this reduction is sufficient to have much effect upon the propagation of the disease. It is probable that the tendency at such times to keep dogs confined in order to prevent them from being seized has more influence in arresting the propagation of rabies than has the mere reduction in numbers.

In nearly all cases when reliance has been placed upon the one measure of reducing the canine population the result has been unsatisfactory. What other disease would we attempt to stamp out by simply killing off one-fourth or one-third of the animals of the species affected? And if this measure is not efficient with other diseases, why should we expect it to be with rabies? It appears self-evident from a sanitary point of view that there should be some direct measures instituted to prevent the propagation of the contagion. Such a measure would be the quarantine and confinement of all dogs for a sufficient time to cover the ordinary incubation period of rabies. As the enforced and continuous confinement of dogs without open-air exercise for a prolonged period may be detrimental to the animals, they may be allowed in public places under such conditions as will absolutely prevent them from biting, that is, the animals should wear an efficient muzzle, or they should be muzzled and led in leash. As rabies is only propagated in nature by biting, such a regulation, if thoroughly enforced, would at once stop the transmission of the disease and soon lead to its disappearance. When this measure is inaugurated, however, it is at once opposed by a large class of citizens who hold it to be cruel and unnecessary. Some muzzles are unquestionably cruel, but a properly made muzzle is not cruel, nor does it greatly inconvenience the dog after he becomes accustomed to it. The authorities should, therefore, prescribe the kind of muzzle to be used, and should select one which covers the mouth with a wire cage so as to prevent biting without interfering with the movements of the jaw and the ingestion of liquids.

There have been many who have denied the utility of the muzzle, the strongest argument being that dogs do not wear it at home, and when they develop rabies and escape it is always when they are unmuzzled. Admitting the force of this argument, it is nevertheless a fact that if all dogs were required to be muzzled when in public places, the appearance of a dog without a muzzle would at once attract attention, leading persons to avoid it and causing its early seizure by the authorities. Children might be instructed that an unmuzzled dog was dangerous and that they should keep at a distance from it, and especially that they should never touch or fondle such an animal.

The results which have been obtained by muzzling justify its enforcement wherever there is an outbreak of rabies. Most of us have heard of the experience of Berlin with this measure about the middle of the century. From 1845 to 1853 there were received at the Berlin Veterinary School 278 rabid animals. This is an average of 35 a year. From March, 1852, to the same month in 1853 the number was 82, and from March, 1853, to the end of July there were 37 more. On July 20 it was ordered that the use of the muzzle should become general. From July to the close of the year but 6 cases were admitted. Only 4 cases were observed in the whole city during 1854, and but a single case in 1855. For the seven years following there was not a single case recorded.[1]

While some have attributed the disappearance of rabies from Berlin at the time mentioned to other causes, muzzling has been adopted in Germany as the principal reliance in repressing this disease. It appears that the number of cases of rabies in Berlin increased progressively after 1863, until in 1868 it reached 66, declining again to 7 in 1870, only to increase in 1872 to 69. In 1875 a law was passed, extending to the whole of Prussia, which provides that all dogs suspected of rabies shall be immediately killed, as also all animals which it is evident have been bitten by rabid animals, and that all dogs in a district which has been infected by an outbreak of rabies shall be confined, or, when abroad, both muzzled and led. The technical section of the veterinary board in Berlin are of the opinion that the passing of this law, and not alone the existence of the muzzling order in that city, is the cause of the extinction of rabies in Berlin. No case has occurred there since 1883.[1]

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[1] Renault, cited by Bouley, in Rapport sur la Rage, Bul. de l'Acad. de Med., Paris, 1863, p. 725. Fleming: Rabies and Hydrophobia, p. 365.

Consul-General Mason reports from Berlin to the State Department that "in Berlin, Frankfort, and, so far as I know or can ascertain, in all cities and large towns in Germany, dogs are required to be muzzled whenever they are on the street or public place, and this regulation is enforced in cities even when the dog is led or held in leash by the owner, or is harnessed for working purposes to a cart or other vehicle."[2]

Fleming states that "in Vienna rabies was entirely suppressed by eighteen months of stringent muzzling, but that in 1886 the muzzling order was rescinded and badges had to be worn on dog collars instead; in the following half year there was only one case of the disease, but in the next half year rabies became epidemic, and the muzzle had again to be worn, with the result that the malady soon subsided and disappeared."

In Holland, before 1875, rabies was prevalent to a very serious extent, but in June of that year the use of the muzzle was ordered, with the result that in the autumn the number of cases fell to 41; in the next whole year there were 55 cases; in 1877 there were 14; in 1878 there were 4, and in 1879 there were 3. These, and the cases which have since been reported, occurred only on or near the frontier of Belgium, in which country the muzzle is not in use, though rabies is always prevalent.

In the Grand Duchy of Baden during the years 1871, 1872, 1873, 1874, and 1875 the number of cases of rabies was, respectively, 18, 37, 37, 50, and 43. Then the muzzle was rigorously applied, and in 1876 there were 28 cases; in 1877, 3; in 1878, 4; in 1879, 2; in 1880, 2; in 1881, 2; in 1882, 3; in 1883, 2; in 1884, 2. Since that year only 1 case has been observed, and that was a dog from Metz contaminated before its arrival in Baden.

In Sweden rabies was at one time a somewhat common disease, and annually from 8 to 10 people died of hydrophobia; but, muzzling being enforced, and the importation of dogs prevented, rabies has been unknown for many years, and no deaths from hydrophobia have occurred since 1870.

The value of the muzzle in suppressing rabies has been perhaps best demonstrated in London on several occasions, and specially in 1885. In the previous years hydrophobia had increased to a very alarming extent in England, and no steps worthy of note had been taken to check the mortality. For London alone in that year no fewer than 27 deaths were reported as due to the bites of rabid dogs. A muzzling order was then enforced, and at the end of 1886 not a death was recorded. Unfortunately, the order prescribing the use of the muzzle was then rescinded, and in a few months a case of hydrophobia occurred in the south of London, soon to be followed by others, and in 1889, 10 deaths were registered. In July of that year the muzzling order was again issued and stringently carried out, and rabies and hydrophobia once more disappeared.[1]

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[1] Fleming: Paper read before the Seventh International Congress of Hygiene and Demography, London, 1891.

[2] Consular Report, June 19, 1900.

In the whole of Great Britain the results from enforcing the muzzling order have been phenomenal, both in the opposition encountered by the authorities and in the successful eradication of the disease. The number of rabid dogs officially reported was, in 1887, 217; 1888, 160; 1889, 312. In the last-mentioned year muzzling was adopted, and the number of cases fell to 129 in 1890, 79 in 1891, and 38 in 1892. Then, owing to persistent opposition, muzzling was stopped, and the effect of withdrawing this measure was at once seen in the increase of rabies. In 1893 there were 93 cases; in 1894, 248, and in 1895, 672. At this point, owing to public alarm, muzzling was again enforced, reducing the number of cases in 1896 to 438, in 1897 to 151, in 1898 to 17, in 1899 to 9. As no case was discovered from November, 1899, to March, 1900, it was believed by the veterinary officer that the disease had been extinguished from Great Britain.

These examples are certainly sufficient to demonstrate the value of muzzling as a means of repressing rabies, and it may be added that in countries like France and Belgium, where muzzling has not been adopted, the disease continues to prevail to a very serious degree.

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[1] Fleming: Paper before Seventh International Congress of Hygiene and Demography, 1891, quoted by committee on public health of the Medical Society of the District of Columbia, Bul. No. 25, Bureau Animal Industry.

MARKET MILK: A PLAN FOR ITS IMPROVEMENT.

By Raymond A. Pearson, M. S.,
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INTRODUCTION.

Public interest in the quality of market milk is increasing. Physicians, sanitarians, milk consumers, and progressive milk producers and dealers seem to appreciate more than ever before that there is the greatest variation in the quality and wholesomeness of milk sold in our cities, and that it is highly important for this article of food to be always pure. In some cities it is extremely difficult, if not impossible, to get a regular supply of milk of really good quality. In other cities milk of the best quality is sold in very limited quantities. Many residents who would like to get the benefit of this kind of service do not know that it is available or they do not know who can be depended upon to furnish it.

The reasons for securing an abundant supply of pure milk are so many and so important that the public should be especially interested in this subject and should assist in bringing about an improvement. Some of these reasons may be stated as follows:

(1) *Milk is one of the most common articles of food.*—Next to bread and water, milk is probably more commonly used than any other article of food or drink. In cities and towns almost every house receives daily a supply of milk or cream. This is used at nearly every meal and, with few exceptions, by every member of the household. It is an article of food in which everyone may be said to be interested.

(2) *Milk is a nutritious, economical, and with many a favorite food.*—It has always been known that pure milk is a valuable food. It contains in easily digestible form the four kinds of nutrients required by the body, namely, protein, fats, carbohydrates, and mineral matter. It is also one of the cheapest of foods, as it contains more nutritive matter than can, with a few exceptions, be obtained at the same cost in other foods. The economy of adding milk to the family dietary has been shown by Jordan,[1] whose experiments "indicate that milk should not be regarded as a luxury, but as an economical article of diet which families of moderate income may freely purchase as a

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[1] U. S. Dept. Agr., O. E. S. Bulletin No. 37.

probable means of improving the character of the dietary and of cheapening the cost of their supply of animal foods."

Many persons use as little milk as possible, because the knowledge they have of the careless way in which *some* milk is produced makes it repugnant to them. They fear that they will be served with this kind and by it will be poisoned or that the germs of some disease will be brought to them. This fear is so great that some families almost exclude milk from their dietaries, instead of making an earnest effort to obtain a thoroughly good and safe article.

(3) *Milk is usually used in the raw state.*—Unlike other foods, milk seldom passes through treatment by which dangerous germs, if it contain such, are destroyed before it reaches the consumer. Most other foods are cooked before they are eaten and most, if not all, of the bacteria they contain are thus killed by heat. Instead of being killed after introduction into milk, bacteria increase at a rapid rate.

(4) *Impure milk may cause serious and even fatal diseases.*—Frequently cow's milk is the only nourishment taken by infants and invalids, and it is these who are least able to withstand the ill effects of impure foods. The practice is increasing of rearing children on substitutes for mother's milk, and especially on cow's milk. When pure, the latter has no superior for this purpose, particularly if its composition has been slightly altered to more nearly resemble human milk. Vital statistics show that about one-third of all deaths are of infants, and that a very large percentage of these die from diseases of the digestive tract. These diseases are said to be due principally to impure food. It is, therefore, reasonable to assert that the mortality of infants has a close relationship to the wholesomeness of the milk supply. In certain districts, where earnest efforts have been made to improve the milk supply, the mortality of infants has been much reduced.

Outbreaks of disease have been definitely traced to infected milk. Among the most common diseases carried in this way are typhoid fever, diphtheria, and scarlatina. There is little doubt that tuberculosis is also spread by infected milk. Derangement of the digestive tract may be caused by the comparatively harmless bacteria which are ordinarily found in milk, being present in exceptionally large numbers. The astonishingly large content of 50,000,000 germs per cubic centimeter has been reported in some instances in the milk delivered in cities.

(5) *The quality of milk can not be easily detected by its appearance.*—The quality of most foods can be judged by their appearance. This is not the case with milk. It is doubtful if any article of food can be adulterated or contaminated without changing its appearance to such an extent as is possible with milk. Some people think it is a simple matter to judge the quality of milk by its color, taste, keeping properties, and the (visible) sediment; but such is not the case.

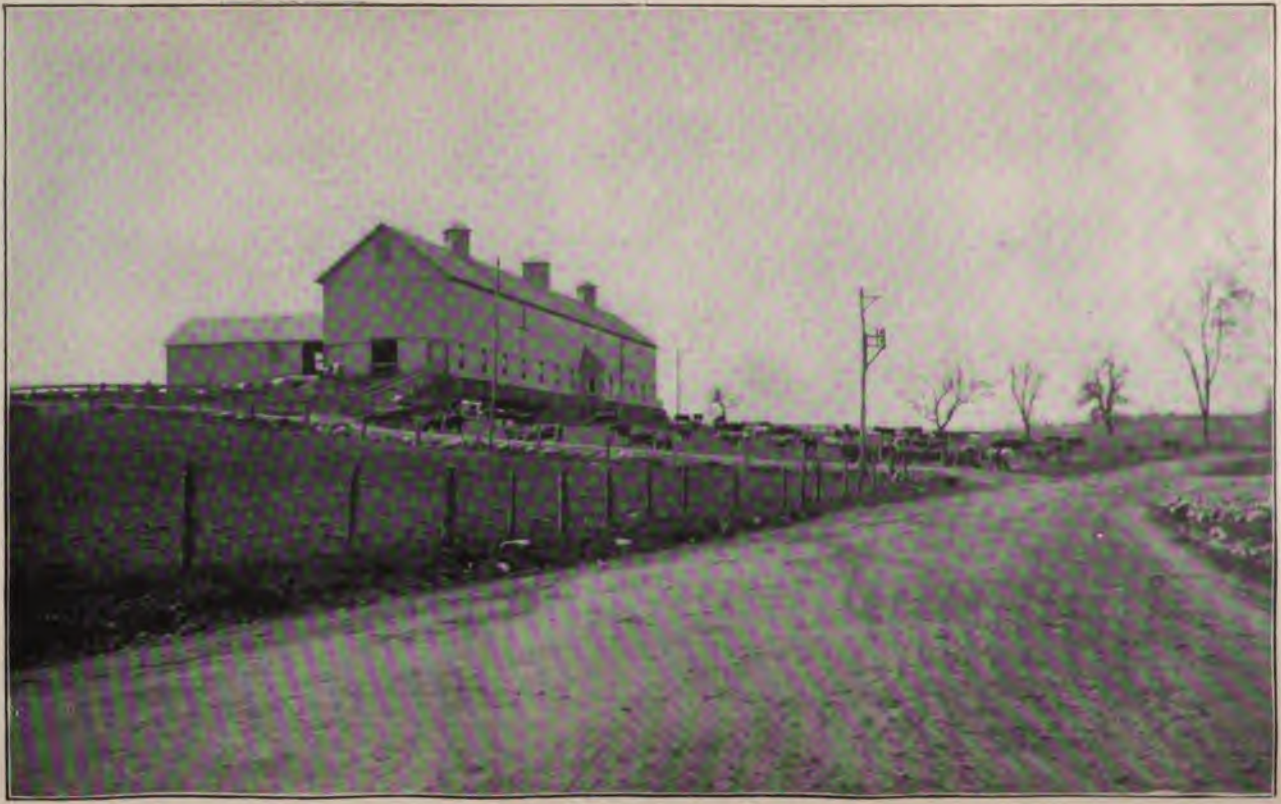
Although these are indicators, they can not be depended upon. Even expert dairymen are liable to be greatly mistaken in opinions based upon them. Skimmed milk having a yellowish tinge may easily be mistaken for whole milk, and, much more important, milk of an actually dangerous character may not differ in appearance from the pure article. It may look the same whether it contains 200 or 200,000 bacteria to the cubic centimeter.

Accurate tests for quickly determining the quality of milk have not yet been made so simple and cheap as to induce their general use. The proportion of fat that milk contains can be measured in a few minutes, but it is not to be expected that many householders will ever be supplied with the necessary apparatus for such tests. And pathogenic bacteria in milk can be recognized only by a trained bacteriologist, who requires several days to make an examination.

(6) *It is impossible for most persons to personally inspect the source of their milk supply.*—Most of the milk delivered in large cities is brought long distances and passes through the hands of dealers who are supplied from many farms, and it is impossible for a customer to always know from what dairy his milk is shipped. Families in small towns and a few cities who are served directly by producers can visit the farms and inspect the conditions, but in most cases such visits would be inconvenient or impracticable, and to make them frequently would be out of the question. Another difficulty is that many residents of cities do not know what conditions should be found on a dairy farm and their criticisms might he unreasonable, omitting some important matters and noting others of very little importance.

(7) *Many milk producers and dealers would improve their methods if they appreciated the importance of so doing and were told just where and just how to make improvements.*—The operators of some inferior dairies really do not know what is meant by a *clean* dairy. They point with pride to what is under their charge, and perhaps call the special attention of the visitor to their close, dark stables, thinking that the cows are thus kept comfortable. Sometimes the source of the water supply is so near the stables as to endanger the purity of the water. Careless, slovenly methods of work are found in such places. Those in charge seem to have the idea that nothing better is required, desired, or even possible. Some of these people are capable of being taught better methods, while with others this would be a hopeless task. It is doubtless correct to say that the miserable conditions of not a few dairies are due to ignorance rather than to intentional negligence, and would be remedied if dairymen were shown the need and told how to proceed.

Incredible as it may seem, the writer has frequently met the owners of such places as are described below and found them equally confident in the purity of their dairy products. The following descriptions



A WELL-LOCATED NEW JERSEY DAIRY BARN.

A VIEW IN A MODEL DAIRY.

CURRYING COWS IN A MODEL DAIRY.

are of two very unlike dairies in the same vicinity, and sending milk to the same market:

The herd consists of 75 native cows, fed corn meal and brewers' grains.	The herd consists of 40 native cows, fed corn meal and brewers' grains.
The stable and cows are in excellent condition.	The stable is poor and very dirty, and the cows are filthy and closely packed together.
The manure is taken daily to a distant field and the stable yard is clean.	A pile of manure as high as the window sills surrounds the stable and the yard is correspondingly faulty.
Eight hundred quarts of milk are produced daily. It is stored in an ice house and cooled with ice, being at 40° to 50° when sold.	Two hundred and forty quarts of milk are produced daily. It is carried to the house, nearly a quarter of a mile away, and cooled in a tank of ice water, being at 50° to 60° when sold.
Water for the stock and for washing utensils is supplied by a well and spring conveniently located, but sufficiently distant from vaults and stable yard.	The well is near the house and less than 100 feet from a privy vault. This water supplies the stock and all other purposes.

In this paper a practical plan for the improvement of market milk will be described, which, it is believed, could be easily adopted in many places and would be beneficial alike to those who wish to procure the best that can be produced and those who wish to produce it. It is somewhat similar to a plan that has been in successful operation for several years and has been approved by progressive dairymen and milk dealers as well as by physicians, city officials, and others having knowledge of it. Besides being definite in its requirement of conditions deemed essential where milk is produced (many of which conditions are new and not known to producers), it has the advantage of being a voluntary measure. Instead of alarming consumers and decreasing the quantity of milk used, it is believed this plan would create public confidence and increase milk consumption. Furthermore, it places a premium on enterprise and honesty on the part of dairy farmers.

MILK COMMISSION.

A responsible body of citizens who are interested in an improved milk supply, and having the confidence of the community, should be organized as a milk commission, to have full control of the work proposed. The commission should select and secure the advice and assistance of four experts—a veterinarian, a physician, a bacteriologist, and a chemist—all more or less familiar with the conditions and possibilities on dairy farms. The commission should send to each dairyman who supplies milk to the city a circular naming all the particular conditions which should be found on every farm where milk is produced for city use, and announcing that when any dairyman notifies the commission that he is fully conforming to the conditions specified, or endeavoring to do so, his dairy will be inspected; and, if it is found to comply in letter and spirit to all the requirements, his name will be placed upon an "approved" list and he will receive an official indorsement in the form of a certificate like the following, which he can use in any proper manner to assist in securing new trade:

CERTIFICATE OF THE BRANTON MILK COMMISSION,
Branton, New York.

THIS IS TO CERTIFY That the dairy farm of *John Doe* at *Farmington*, and the herd thereon, which furnishes milk sold in this city by *Samuel Smith*, have been thoroughly examined and found to comply with the conditions recommended by this commission. These include a healthy herd, the use of pure feeds, appropriate stabling and care, clean and prompt handling of the milk, which is of good composition and quality and free from pathogenic and unnecessary bacteria. The attendants are cleanly and free from communicable disease.

In evidence of which this certificate is granted said *John Doe* for a period of

THREE MONTHS FROM THIS DATE; NAMELY, FROM *March 15, 1901.*

but subject to be sooner canceled, for cause.

——— ———,
Chairman.

——— ———,
Secretary.

NOTE. This certificate, or a correct copy of it, must be conspicuously displayed in each store and upon or in each vehicle from which the milk of this farm is sold.

——— ———.

Successive certificates to the same dairy might be in different colors. Evidence of certification such as the above certificate in reduced size or a brief statement on a special slip or cap should accompany every bottle of milk, showing also the date of milking. The commission should take necessary legal steps to prevent the counterfeiting or improper use of its certificate.

It will be necessary to make inspections at least once every three months (but at irregular intervals), in order to insure maintenance of the prescribed standard. Any neglected condition which may be found should immediately be reported to the commission, which will decide whether or not the cause is sufficient to withdraw and cancel the last certificate issued.

PERSONNEL OF COMMISSION.

The personnel of the commission having charge of the movement is very important. It should be composed of any competent persons especially interested in a pure-milk supply, who understand what is essential for it, are willing to make some personal sacrifice to bring it about, and who have the confidence of the community. The members should possess good executive ability, as their work must be conducted in a business-like way, and will be successful only in proportion as this is done. The duties might be arduous at first, but this need not last long. After the system is fairly started the principal service of the commission would be to act as referee, the clerical work being in charge of a secretary, and inspections being made by experts. There are few cities where the question of a better milk supply has not been more or less agitated, and physicians are usually the ones most active in urging improvement. As the changes needed are chiefly along sanitary lines and for the benefit of the public health, it is appropriate that the medical profession should take a prominent part in the movement. The fact that physicians as a class have the full confidence of the community is another reason why they should take an active part.

A representative voluntary organization might be formed for this purpose, but a committee appointed by a board of health, an influential civic club, or a leading medical society, with the understanding that their efforts would have the support of the appointing body, would start work under more favorable auspices. It is doubtful if there are many important cities or towns where such committees could not be formed. Care should be taken to have the plan of work understood and approved by public opinion.

EXPERTS.

It will be seen that at least four experts would be required to assure the observance of all the conditions. As stated, the experts selected by the commission should be familiar with the conditions and possibilities of dairy farms. The more these officers understand of modern dairy science and the details of dairy work, the better. Unless thus qualified they are liable to be unreasonable and thus bring the movement into disfavor. They should be able to give practical advice to dairymen when needed. Their examinations should always be without previous notice.

It should be the duty of the veterinarian to examine the cattle, stables, drainage, ventilation, food, water, yards, pasture, methods of milking and of handling the milk, the exercise of the animals, and all matters connected with their health, care, and management. Also to see that the conditions of the contract relating to these matters are fully complied with. Where there is much of this kind of work to be done, the veterinarian might confine his attention to the herd and its management and the immediate surroundings, while other inspectors (expert dairymen) could look after the sanitary conditions outside of the stable and the general subject of the care of the milk.

The physician should examine all persons working about the dairy or in any way connected with the care of the animals, milk, and utensils, and the transportation and delivery of the milk, in relation to their habits of cleanliness as well as for transmissible diseases, and this as often as is deemed necessary.

The bacteriologist should examine the milk to test the efficiency of the methods in force. He should take samples at the farm, and when the milk is being delivered to the consumers, and by a bacteriological examination (usually only the counting of the bacteria) and a microscopic examination, determine the nature of the bacterial content and if pus cells are present. His examinations should be made every few weeks, and will be the truest indication of the thoroughness with which the requirements are being followed. Experience shows that it is not unreasonable to expect milk free from pus cells and pathogenic bacteria, the other bacteria of which will frequently number fewer than 1,000, usually under 10,000, and seldom over 20,000, per cubic centimeter.

The chemist should make examinations sufficiently frequent to determine if the milk be of correct composition, of requisite richness, and free from adulteration. A fair standard of the composition and quality of good milk is 4 per cent of fat. With reasonable care, milk can be kept at an average which will be within one-half of 1 per cent of this standard. Some fluctuation in the measure of fat is sure to occur, and an occasional drop even below 3½ per cent for a day or two should not result in condemnation. If the average remains above 4½ or below 3½ per cent for any length of time, the purchasers of the milk should be notified.

CONDITIONS TO BE REQUIRED.

The success of the whole scheme will depend largely on the conditions required and the detail in which they are stated. The fitness of a dairy for approval should not be left entirely to the judgment of any individuals. All the requirements should be so fully and plainly stated that there can be no doubt as to their meaning; otherwise, even the most capable and conscientious inspectors might be accused of unfairness in their reports. The dairyman should know exactly what he is expected to do, and should be able to easily see how others maintain such conditions.

The requirements should not be needlessly numerous and restrictive, but should include an explicit statement of the conditions that are approved and deemed necessary by dairy authorities for producing pure milk. They should refer in unmistakable terms to the essentials in connection with the herd, buildings, equipment, methods of conducting the work and handling the milk, and should leave no doubt in the mind of the intelligent dairyman as to how milk should be produced in order to be clean, pure, and of good quality. Only a few years ago it would have been impossible to have made definite recommendations along all these lines, but such investigations and experiments have been reported that many former mysteries are now well understood facts. Besides including the essentials for the production of the purest milk, the conditions should provide for affording every facility to members of the commission, or their representatives, for making examinations at any time. It would be easy to make the regulations very brief by the use of general terms. For example, it might be said "The stabling and care of the stock shall be such as is usually approved," and "The buildings shall be cared for in a proper manner," and "All utensils shall be thoroughly cleaned;" but such rules might mean different things to different readers. Doubtless many would incorrectly understand that the use of warm water and soap would be sufficient to fulfill the last requirement as stated. Instead of such general expressions it is proposed to state explicitly those methods which are proper, thorough, and of proved efficiency. Under some unusual conditions it might be desirable to modify certain of the requirements, which the commission should have full power to do upon the recommendation of its experts.

A set of requirements follows which are suitable for incorporation in the agreement between the dairyman and the commission. With such rules in his hand, the inspector should have little trouble in determining just where failures have been made and in pointing them out to the dairyman. It should be remembered that practically these same rules are being carefully followed on successful dairy farms, located in several different States.

REQUIREMENTS.

GENERAL.

Every facility shall be afforded at all times to members of the commission or its representatives for making examinations. Samples of milk for examination shall be furnished whenever requested.

Whenever requested, the dairyman shall furnish transportation for the representative of the commission between the farm and the most convenient railroad station, or from his farm to a neighboring one.

This agreement can at any time be declared void by the commission.

LOCATION OF BUILDINGS, PASTURES, ETC.

The location of the stable, dairy, and pastures shall be subject to the approval of the commission.

All buildings shall be so located that they will have good drainage. The stable shall be on relatively elevated ground.

No building used for dairy purposes shall be within 200 yards of any marshy ground or stagnant water, and no chicken coop, hogpen, horse stable, privy, water-closet, or urinal shall be within 100 feet of the building for keeping or handling milk.

The surroundings of all buildings shall be kept clean and in good order. The accumulation of dirt, rubbish, manure, or decayed matter shall not be permitted.

WATER SUPPLY.

The dairy shall be supplied with an abundance of pure water, the source of which shall not be within 250 feet of the stable or of any barnyard, privy, or other possible source of contamination.

Water from wells or springs which are not protected against the entrance of flood and surface water shall not be used for cooling milk or cleaning utensils.

A sample of the water shall be furnished to the commission at any time requested, and the water shall be examined at least once every year.

STABLES.

The stable shall be arranged with a view to the comfort of the animals and so as to facilitate the work of cleaning, milking, etc.

The floor shall be smooth and incapable of absorbing liquids, and sloping sufficiently to cause good drainage.

The gutters behind the cows shall be open and with sufficient incline to cause good drainage.

The side walls and ceiling shall be so tight as to prevent dust sifting through, and they shall be so constructed as to prevent cobwebs and dust from collecting and easily to be cleaned.

There shall be windows in at least two sides of the stable, providing not less than 3 square feet of unobstructed window glass to each animal.

Each animal shall be allowed at least as many cubic feet of air space as the number of pounds of its live weight.

The ventilation shall be so efficient that one will not notice a stale, disagreeable, or strong animal odor on entering the building.

The stalls shall be comfortable, at least 3 feet wide, or 3½ feet for a large cow, and so long that the animal need not habitually stand with feet in the gutter.

The stable yard shall be well drained so as to be usually dry, and no pools allowed to form.

A suitable place, at least 200 feet distant from the stable building, shall be provided for cows not approved by the veterinarian and those separated from the herd for any cause except calving.

A special room, conveniently located, shall be provided for the milkers to wash in before and during milking.

The stable shall be kept scrupulously clean.

The interior walls shall be kept clean and light colored. If whitewash is used, a fresh coat shall be applied at least three times a year, and oftener, if necessary, to keep the walls clean and white. Mold spots shall not be permitted.

The accumulation of dirt, cobwebs, rubbish, and materials not needed for stable work shall not be permitted.

At least half an hour before milking time, stables shall be thoroughly cleaned and ventilated and manure removed from the building.

The stable floors shall be sprinkled when necessary, to keep down the dust.

When cows are kept in the stable continuously (as in stormy weather), it shall be cleaned often enough to be kept as free as possible from manurial odors. If necessary, land plaster shall be used for absorbing liquids and odors.

At least once every two months the mangers shall be scrubbed with a brush and water and soap, lye, or washing powder.

Animals of other species shall not be kept in the same room with milch cows.

No strong smelling material shall be allowed in or near the stable. If manure is on the premises, it shall be at least 100 feet distant from the stable.

THE DAIRY HERD.

The herd shall include no sick animal, and especially none showing signs of tuberculosis, contagious abortion, or other trouble associated with parturition, or with mammitis, mammary abscess, or other udder disease, persistent diarrhea, actinomycosis, fever, or any febrile disease. Such animals and any other diseased animal on the farm shall be promptly reported to the commission and disposed of as it directs.

The herd shall be examined thoroughly by the veterinarian of the commission at least once in three months and whenever ordered by the commission, and animals unsatisfactory to the commission shall be removed. The herd shall include no animal not approved by the veterinarian.

Animals proposed to be added to the herd shall be kept in a separate building until approved by the veterinarian, after a physical examination and tuberculin test.[1]

Tuberculin shall be used in examination for tuberculosis whenever there is reason to suspect the presence of this disease.

Any animal showing evidence of ill health or suspected of being ill, and any animal off feed or excited, shall be at once removed from the main stable and the milk of all such shall be discarded from the market milk.

Milch cows shall be groomed not more than one hour before every milking. A stiff brush shall be used to remove dry matter and places soiled with fresh manure shall be cleaned by washing.

Long hair on the udder and flanks shall be clipped.

Cows shall not be exposed to inclement weather.

Cows shall never be unduly excited by loud talking, abuse, or otherwise. They shall not be driven faster than a walk. They shall at all times be treated quietly and kindly.

Any cow in the habit of hooking others shall be either dehorned or separated from the herd.

No dusty or moldy hay or straw, bedding from horse stalls, or other unclean material shall be used for bedding cows.

Cows shall be removed from the stable in which the herd is kept at least fifteen days before due to calve and shall not be returned until at least three days after calving.

The herd milk shall be maintained at an average quality to test not less than 3.5 per cent of fat and as close as possible to 4 per cent.

FEEDING AND WATERING.

All food stuffs shall be kept in an apartment separate from the animals.

Only those foods shall be used which consist of fresh, palatable, or nutritious materials, such as are known will not injure the health of the cows or affect the taste or character of the milk.

Cows shall be fed liberally and regularly—that is, in the same order and at the same hour every day.

A well-balanced ration shall be used and changes of feed shall be made slowly. An entire change of grain shall be made only gradually, extending over several days.

The ration shall be reported to the commission whenever it is proposed to materially change it, the changes being named.

If garlic or other weeds which cause undesirable flavors in milk are in the pasture, cows shall be brought to the stable long enough before milking so that the weed flavor may not be noticeable in the milk. A light feed of hay or some sweet forage before milking appears to assist in the removal of weed flavors.

No dry or dusty food shall be given within one hour previous to milking; if its use is necessary, it shall be sprinkled before it is fed.

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[1] Many of the cows supplying milk to cities are brought from a distance and tuberculosis has been introduced in this way to herds where it was not before known. Several States, namely, Vermont, New Hampshire, Massachusetts, Rhode Island, New Jersey, Pennsylvania, and Illinois, require all cattle entering their limits for breeding or dairy purposes to be tested with tuberculin under the supervision of State officers, unless they are accompanied with a recent health certificate of this character. If this is considered of sufficient importance to be included in State laws, a similar rule should certainly appear here to protect against diseased cows entering the approved dairies, whether they come from other States or not, as it is known that no State is free from this disease.

Cows shall be watered at least twice a day.

Pure water shall be provided in abundance and easy of access; it shall be fresh but not freezing cold.

Cows shall not be allowed to drink regularly from stagnant pools.

Salt shall always be accessible or given at frequent intervals.

EMPLOYEES.

Employees shall be clean in habits and appearance.

They shall be continually vigilant to keep everything connected with the cattle and milk scrupulously clean and in good order.

The dairyman shall keep informed as to the health of all employees and the members of their households.

No person having throat trouble or being otherwise out of health shall be admitted to the stable or dairy room.

The existence of smallpox, typhoid fever, diphtheria, scarlet fever, measles, or other contagious disease on or in the vicinity of the dairy farm shall be promptly reported to the commission, and the sale of milk shall be stopped till its resumption is authorized.

No person connected with the dairy shall enter a house where it is known that there has been a contagious disease until it has been disinfected.

No employee or other person shall be permitted in the dairy who has been in contact with any contagious disease.

While engaged about the dairy or in handling milk, the use of tobacco or intoxicating liquors shall not be permitted.

MILK ROOM.

There shall be a room which shall be used for no other purpose than to provide a place for handling the milk, storing clean milk utensils, and holding fresh milk previous to its removal from the dairy.

It shall be within easy access of the stable, but so placed that it can not easily be reached by dust or odors from the stable or yard or other source.

If under the same roof with the stable, it shall be separated therefrom by a light, clean, and ventilated room or passageway at least 4 feet wide and 4 feet long, with doors kept closed by springs. Or the arrangement shall be such that it will be necessary to pass out-of-doors in going from the stable to the milk room.

This room shall be entered only by persons having business therein; no one shall be admitted who has been where a contagious disease exists or who is wearing dirty garments.

It shall be kept scrupulously clean and shall be occasionally thoroughly dried in all its parts.

It shall contain nothing that is not required for handling milk.

Dairy utensils shall be removed to another room for cleaning as soon as they have been used.

Sour milk shall not be left in the milk room.

It shall be well lighted.

Windows and doors shall be fitted with screens to keep out insects.

It shall have a hard floor, impervious to moisture.

The drain shall be provided with a common S-trap, and so constructed that it can easily be cleaned by steam or disinfectants. Except under unusual conditions, the drain shall be at least 200 feet long.

No permanently moist place, except running water, shall be allowed in its vicinity.

The walls and ceiling shall be kept clean and light colored. If whitewash is used, a fresh coat shall be applied at least every three months, or oftener if necessary, to keep the walls clean.

Spots of mold shall not be allowed to develop on the walls.

If there are shelves of wood in the room, they shall be painted or oiled.

No accumulation of dirt, cobwebs, rubbish, or unclean materials shall be permitted.

MILK UTENSILS.

So far as possible, dairy utensils shall be made of metal, glass, or glazed earthenware, and shall be of simple construction so as to be easily cleaned; joints and rims of metal utensils shall be smooth and cracks entirely filled with solder.

No milk vessels shall be used which are old, rusty, or dilapidated.

Vessels used for carrying milk shall be used for nothing else.

No milk vessels or utensils except pails shall be taken into the stable or milking room.

All utensils shall be cleaned in a separate wash room (not in a dwelling house or in the milk room), especially fitted for the purpose, containing a boiler and a tight chest for steaming or ample facilities for sterilizing with boiling water.

All utensils shall be cleaned immediately after use.

Before cleaning, milk utensils shall be rinsed with cold or lukewarm water; they shall then be washed thoroughly with hot water with the aid of some cleaning preparation (other than laundry soap or inferior washing powder), as sal soda, then rinsed with clean water and sterilized by exposure for at least ten minutes to live steam or water that is actually boiling.

Every part of an article, outer as well as inner surfaces, shall be cleaned with a brush, or be in plain view when cleaned.

After cleaning, vessels shall be kept inverted, without covers, in a clean, dry, dustless, and odorless atmosphere.

Cleaning cloths shall be washed and sterilized daily.

Sponges shall not be used for cleaning.

MILKERS AND MILKING.[1]

Before commencing to milk, the milker's hands shall be carefully washed, using soap and nail brush, and then rinsed in clean water.

A special suit of clean outer garments of white cotton or linen, and cap, shall be worn during milking and at no other time; when not in use, these must not be kept in the stable or living room, but in a clean and ventilated place.

Just before milking, the udder and surrounding parts of every cow shall be brushed and then wiped with a cloth, clean and damp, but not dripping.

The milker's hands shall be kept dry when milking; they shall not come in contact with the milk.

The first three or four streams of milk from each teat shall be drawn into a separate vessel to be thrown away, but not into the gutter nor upon the floor.

Milking shall be done in a quiet, clean, and thorough manner, and at the same hours daily.

Milkers shall avoid handling the cows more than necessary.

No strange person or animal shall be allowed in the stable or milking room at milking time.

If the milk from a cow is bloody, stringy, or thick, or if it has an unnatural appearance, or if manure gets into it, it shall be discarded and the pail washed and sterilized before it is again used.

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[1] A separate milking room is advocated by some, but it is strongly objected to by others who are succeeding remarkably well in the production of high-grade milk. It could be used, if desired, under this form of contract as there is nothing to prevent moving the cows from one room to another just before they are milked and the requirements of cleanliness, etc., are supposed to apply wherever the cows are kept.

Cows separated from the herd shall be milked after the herd is milked or by other milkers than those employed with the herd. The milk from any cow whose health is suspected shall be discarded, or if fed to farm animals it shall first be heated above 180° F.

CARE AND DELIVERY OF MILK.

Immediately after each cow is milked, the milk shall be taken to the milk room.

It shall then be promptly strained through a fine wire gauze and a layer of absorbent cotton, protected on either side by a piece of cheese cloth.

It shall be thoroughly aerated by some modern appliance and cooled to a temperature of 45° F. or lower. The cooling shall be done within fifteen minutes after being drawn and the milk shall then be kept constantly at or below the temperature stated.

Milk shall be stored, while on the farm, only in the regular milk room, and, except for special reason, it shall be kept in a covered vessel.

When milk is stored in cold water in a tank, the water shall be changed often enough to prevent its having any unpleasant smell or appearance. Care shall be taken to have the water higher than the level of milk in the cans. The storage tank or ice box shall be thoroughly scrubbed out at least once a week. The overflow pipe shall be properly trapped to prevent the entrance of sewer gas.

No ice shall be put into the milk, and it shall not be allowed to freeze.

Night and morning milk shall not be mixed.

No preservative or other substance shall be added to milk for any purpose, and no part of the milk shall be removed.

The addition or subtraction of cream may be practiced when specially permitted by the commission for the purpose of producing milk of guaranteed standard.

Every possible precaution shall be taken to improve the keeping quality of the milk, to maintain its purity, and especially to prevent the entrance of objectionable bacteria.

Milk for retail trade shall be placed in flint glass jars at the dairy where produced, and preferably as soon as it has been cooled, and no jar shall be opened before delivery.

The jars shall be of a pattern which has a comparatively simple and cleanly method of closing.

The jars shall be filled by hand, pouring from a pitcher or can or by a machine constructed so that it may be completely cleaned. Unnecessary spilling of milk when the jars are being filled shall be avoided, and milk so spilled shall not again be put into them.

As soon as filled the jars shall be sealed and a label affixed bearing the date of the milking, the names of the dairyman and distributing agent, also the special mark adopted by the commission.

In warm weather the glass jars of milk shall be kept surrounded by ice water or ice.

Milk packages shall not be unnecessarily agitated and they shall be protected from the heat of the sun.

Milk for wholesale trade shall be in vessels sealed before leaving the milk room.

As much care shall be exercised during transportation as at the dairy.

No milk shall be sent from the dairy which is more than eighteen hours old.

While awaiting delivery in the city milk shall be held in a clean room not used for domestic purposes.

Delivery wagons shall be so constructed as to protect milk from the weather, and all fittings and inside parts shall be cleaned frequently; in warm weather they shall be washed daily with warm water.

The collection of empty bottles and milk tickets or checks from houses where an infectious disease is known to exist, shall be made by other persons and vehicles than those delivering the milk. When returned to the dairy, the bottles shall be taken to a separate building and thoroughly sterilized before being carried to the dairy room, and all such collected tickets and checks shall be promptly recorded and destroyed.

All tickets, checks, and labels on jars or bottles shall be new when delivered to consumers, and none shall be used a second time.

GENERAL CONSIDERATIONS.

A certificate similar to the one suggested on page 162, stating that a dairy is conducted in an approved manner, may be very useful to one who sells milk by assisting in securing fair prices and new trade, for many of the best class of milk users would value the assurance thus given. This was exemplified in a Western city where an effort was made to improve the city milk supply by a somewhat similar method. When it became known throughout the city that a certain dairy had been awarded a special certificate on account of its excellent methods, its business immediately increased, and to such an extent that other dairies were soon pressing for examinations in order that they might secure like certificates. The certificates were awarded by the board of health (not based upon an ordinance, however), and the secretary of the board reports that the movement has been "exceeding successful." The milk from dairies holding certificates is sold at an advance of 1 cent per quart.

In order to make the plan still more attractive to dairymen, it would be well to keep the matter before the public by periodically publishing the list of approved or certified dairies and making brief but pointed statements of the object of the system and of the way to obtain the indorsement. Anyone seeing the list would naturally look for his milkman's name, and, if not found, explanations would be sought. Without doubt, many would insist that those supplying them be on the list.

The plan outlined may seem to be practicable only where milk is sold by the producers direct to the consumers, but it could be extended to apply to dealers who buy milk to sell again—indorsement to be given only for milk which is handled in compliance with all the required regulations and which is from farms approved by the commission. If the milk is to be handled through stores or shops, these should be subject to regulations the same as the farms. Milk can be dangerously contaminated in unsanitary stores, and milk already approved should, after passing through such places, lose this recommendation.

The objection may be made that the small dairymen can not afford to conduct a place in the manner described, and therefore the plan would be unfair. The same objection is applicable to all small manufacturers and merchants—the smaller the business the more expensive, relatively, is its operation; but it seems to be less appropriate here than in most cases. There is no reason why a small dairy can not be conducted in a cleanly way as well as a large one. It will, of course, require some expense to satisfactorily equip and maintain a dairy. Those having only a few cows and whose interests are mainly in other lines might not find it profitable to undertake it, but the necessary improvements need not be out of reach of farmers with large or even small herds, if they are determined to do the thing right and propose to give it all necessary attention; extravagance is nowhere essential. Indeed, some of the most progressive dairymen claim that the slightly increased cost in the production of milk, due to the extra care in its handling, is more than made up by their increased sales to persons who used but little or no milk until they were confident that they could get a pure supply. Furthermore, there is no reason why those who wish to progress should be deterred by the fact that all can not reach the highest standard, even if this were the fact, which many will not admit.

One of the principal advantages of the plan is that it can easily be inaugurated, and those who wish to be helped by it can quickly get its benefits. The numerous class who would oppose the enactment of the regulations into laws for the reason that they would not care to be governed by them would not have the same ground for objection in this case because of the voluntary feature. No one is compelled to come under the commission and its rules. A second advantage is that it gives reliable information to consumers as to where to secure the best milk produced; they are no longer compelled to depend upon either the appearance of the milk or the statements of the venders. Third, the marked improvement of a few dairies would have a beneficial effect on the entire milk supply. This is known to be the case where well-conducted dairies are already in operation; with their increase it would be more apparent. The poorer dairies are obliged to improve to keep their trade. When any considerable part of the local milk wagons display signs showing that their milk is approved by such a commission it is easy to predict the effect upon the trade of the remainder. The latter would be forced to make marked improvements and thus in time it might be feasible to require all who are not in the approved class to come to it. This is a most important advantage, and alone should commend the matter to careful consideration.

The expenses incident to the plan, unless otherwise provided for, should be met by those deriving pecuniary benefits. The members of the commission should serve without remuneration, except perhaps for actual expenses, but the experts and the secretary should be properly paid. The increased receipts from higher prices and enlarged trade should enable the dairymen to pay fees for certificates sufficient to cover necessary expenses. Yet in many cases it would probably be necessary to establish the system upon a philanthropic basis and demonstrate its value before the beneficiaries, including consumers as well as producers, could be expected to bear the expense.

There are good reasons, however, why the expenses of the milk commissions should be paid from the common treasury. Much money and effort are now expended in the attempt to protect the public from dangers incident to the consumption of unwholesome milk and to improve the milk supply by detecting and prosecuting dishonest persons in the endeavor to check their bad practices and discourage others from following their method of doing business. Dairies approved by the commission would work to the same end. If the improvement of the milk supply could be effected more rapidly and with less expense by encouraging this latter class than by the present method such use of the services of public officials and of public money is fully justified. In other words, it would be well if some of the energy now expended to correct the worst dairies could be applied to draw attention to the best ones. People in general would rather have the names of a few dealers who could be depended upon than the names of many to be avoided.

MODEL DAIRIES.

It is seen that the method proposed is one to encourage the so-called model dairies. More persons than is generally supposed are patiently endeavoring to place milk upon the market which is as pure as can be made, but their efforts do not meet the reward deserved. They look at the matter in this logical way: "Pure milk is wanted; it is pure when the healthy cow makes it. Why should it be allowed to become impure and then subjected to questionable processes to overcome the effects of negligence when by proper care it can be pure?"

These persons are not influenced in the least by laws or regulations; they aim to keep their dairies and places of business at all times above unfavorable criticism. It is not necessary to expend any of the public funds to supervise or coerce them. If they are shown that they can produce better milk by any reasonable change of methods or outlay of capital they are glad to make the improvement. It is this class which should be enlarged. They hold a standard for milk which is far above any that it would be practicable to establish by law. They are trained in their work and understand the main principles of breeding, feeding, and caring for live stock and handling milk. From every standpoint these careful milk producers deserve encouragement and any benefits in a business way which can be given to them.

A number of instances of this high-class dairying could be given. One of the largest and most successful dairies in the country is located in New Jersey. Its success is due to the support which it has received from a milk commission organized for its exclusive benefit and conducted in many respects similar to the plan described in this paper. A few years ago a body of physicians made the proposition to a progressive dairyman that they would recommend the milk of his dairy if he would follow their requirements in its production and handling, and he readily consented to such an arrangement. Details need not be given here; suffice it to say that all suggestions for improvement have been adopted. The strictest rules are followed and every employee knows that his work must be done in a thorough and cleanly manner. The herd has continually increased in size until there are now over 400 cows and the 4,000 or more quarts of milk per day average 9 cents a quart to the producer. Dr. Henry L. Coit, of Newark, who has unselfishly labored for many years to secure a better milk supply, and his associates on this milk commission deserve great credit for the success of their work. The suggestion of a milk commission was made by Dr. Coit eight or nine years ago in a paper read before a medical association and, so far as the writer is aware, the commission of which he is president was the first of the kind organized.

Regarding the objects of this New Jersey commission and the requirements of the milk, Dr. Coit has written:

> The objects of the commission are to establish correct clinical standards of purity for cow's milk; to become responsible for a periodical inspection of the dairy under its patronage; provide for chemical and biological examinations of the product, and the frequent scrutiny of the stock by competent veterinarians.
>
> Three general requirements or standards of quality for the milk have been formulated:
>
> First. An absence of large numbers of microorganisms and the entire freedom of the milk from pathogenic varieties.
>
> Second. Unvarying resistance to early fermentative change in the milk, so that it may be kept under ordinary conditions without extraordinary care.
>
> Third. Having a constant nutritive value of known chemical composition and a uniform relation between the percentage of the fats, proteids, and carbohydrates.

A company with headquarters in Boston has been very successful in producing high-grade milk on farms located in different parts of the country and selling it in several large cities. It has received no little aid from milk commissions. This company sells pure natural milk in one city for 15 cents a quart, and yet finds it difficult to supply the demand. An important feature of its business consists in "modifying" milk, or altering its composition according to physicians' prescriptions for the use of infants and invalids; and the success of this branch is due, first of all, to the pure milk from the companies own farms available for the "modifications." Its supply farms are models of neatness and its methods are accurate. The originator is entitled to much credit for establishing the dairies of this company along scientific lines and for the good example set to many others.

There are a number of other dairies supervised by these milk commissions and still others generally recommended by physicians, all of which are succeeding well. Milk commissions in Philadelphia and

New York, and some description of their operations, are referred to in appendixes.

As suggested above, there are some "model" dairies which are not meeting with the success that they deserve. One of the chief drawbacks is that consumers have been deceived so many times by the false claims of milk sellers that it is now hard to convince them of the real genuineness of the product of a well-conducted dairy making special claims. This is partly due to the improper use of attractive legends, such as "Veterinary and sanitary inspection" or "Hygienic milk," in shop windows and on wagons. The Keystone Veterinary Society of Philadelphia recently investigated the dairies of some dealers who were selling milk from wagons marked with such statements in order to find just what these signified. It was learned that they were first used only by the best class of dealers, who were carrying on a more or less strict examination of the herds and farms from which their milk came. Other dealers soon saw they were losing trade to those who made such special claims, and it required but a short time for them to dishonestly adopt the same terms. When asked to what extent veterinary or sanitary inspections were made, it was found that some did not even know the meaning of these words. Others said they were their own inspectors. Others stated they always called a veterinarian when a cow was sick, and some of these admitted that they had had no occasion for professional services for many months. Some said frankly that they saw they were losing trade to others who were making such claims and thought they might as well make the same claims. It is easy to imagine what these unscrupulous persons told their customers when asked about the meaning of the signs. No doubt the same conditions exist in other cities. The citizens imposed upon in this way have good reason to complain. They want pure milk and many are willing to pay for it, but they have no way of knowing where to get it. The careful dairymen can not be blamed for complaining of this state of affairs, as their extra trouble and expense go for naught, and it is a great injustice to them.

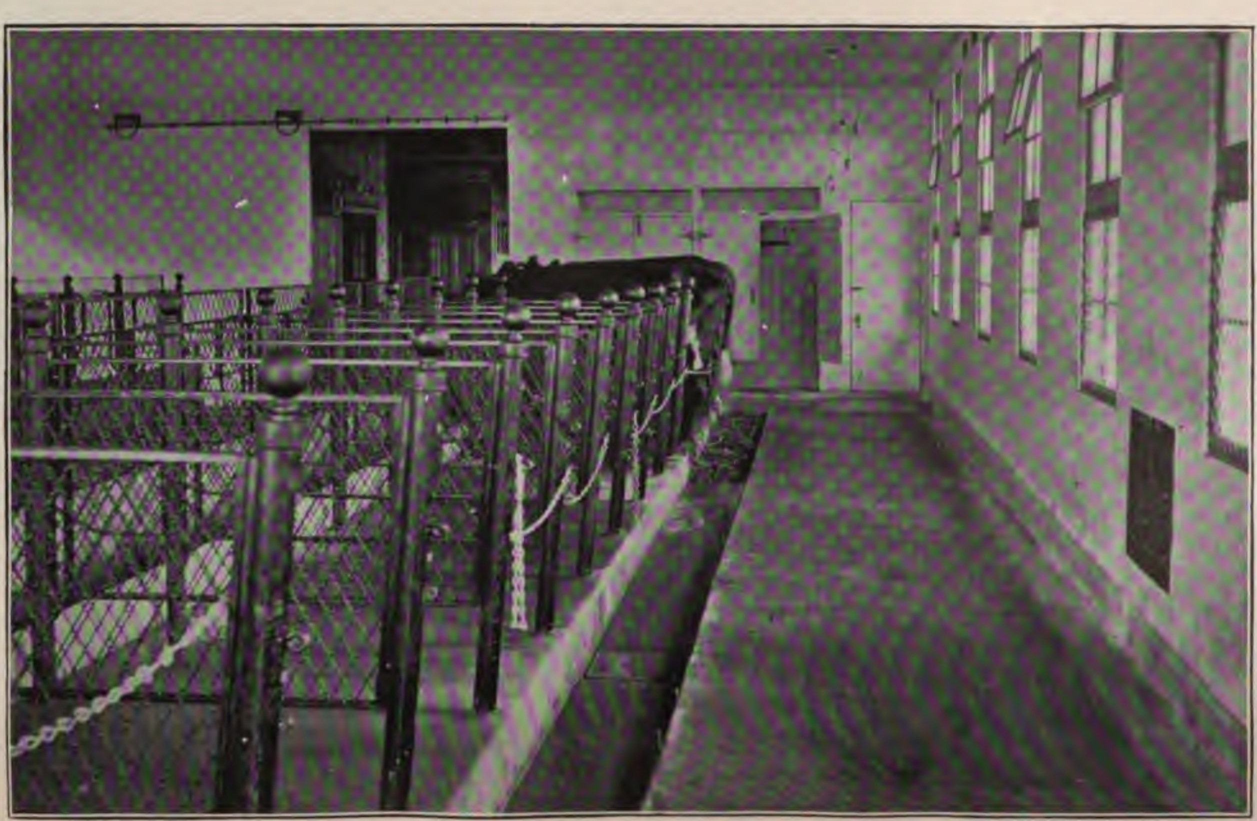
Another difficulty with which the model dairy has to contend is the indifference of those milk consumers who are ignorant about milk and care nothing of how it is produced or handled, and only want a fluid which looks like milk, will furnish a little cream, and will keep fairly well, and which they can get as cheap as possible. Such persons are unwilling to pay the slightly advanced price to which the producer of pure milk is entitled. Probably they are responsible more than any other one cause for the low grade of much milk found on sale in every city and town. It would be an unusual character who would go very far out of his way to provide the best for such customers. They seem to think, if they think of the matter at all, that laws or the personal interests of others, more able and public spirited than themselves, are sufficient to prevent the sale of any food product which is unfit for use. The plan already outlined would tend to overcome both of these drawbacks, as it would attract attention to the wide variation in quality of milk sold by different persons and emphasize the importance of having good milk, and this would naturally be followed by a willingness to pay better prices.

The scientific production of milk for special purposes—such, for example, as clinical feeding—is necessarily expensive, and it is not possible for the dairy farmer to do the needed work with such an aim in view unless he is assured a good support at prices in advance of those usually paid for commercial milk.

DAIRY LAWS AND REGULATIONS.

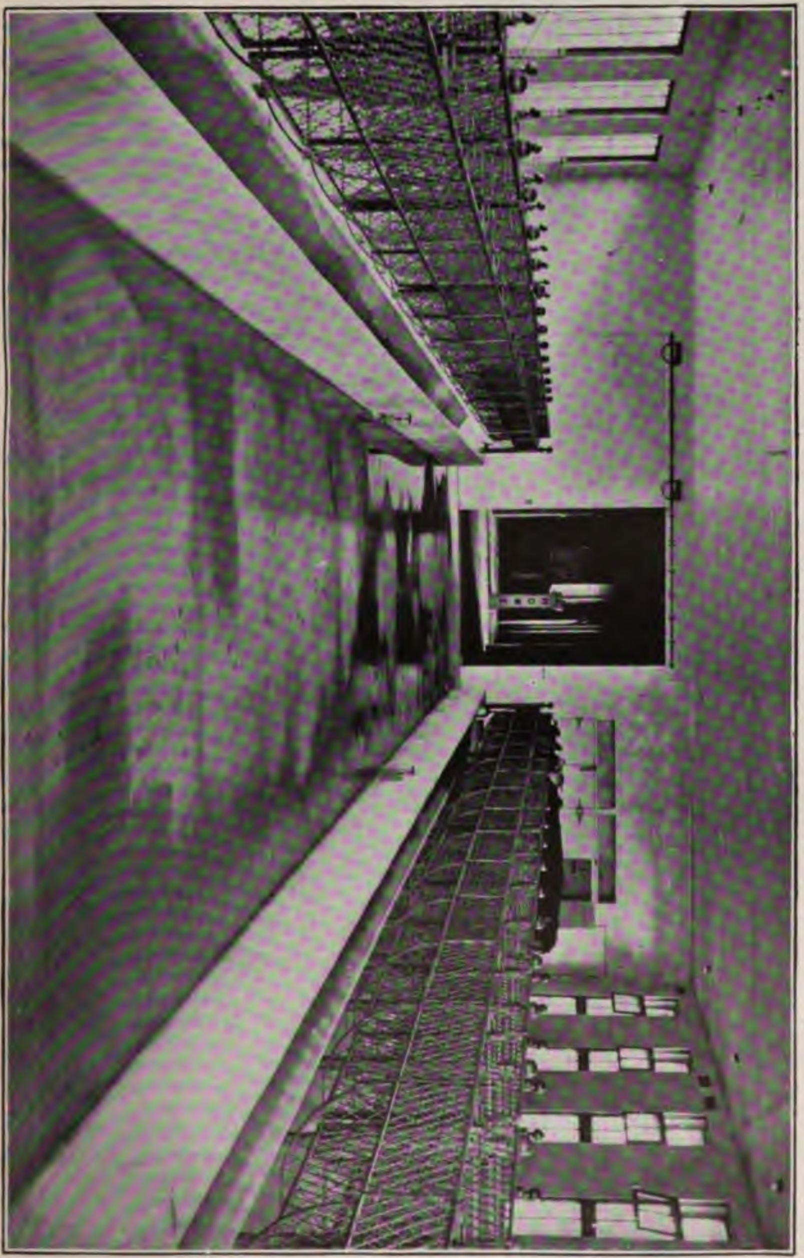
Thirty-one States have laws of more or less detail referring to milk for city use, and practically all large cities have special regulations or ordinances relating to milk. These laws and regulations have undoubtedly done a great deal of good, and their benefits should not be underestimated. But experience has shown that in some respects they are deficient. For example, of what special benefit are milk laws to the person who wants milk of high quality and as pure as it can be produced, or not at all? There are many such persons. Laws do not require the production of that kind of milk, and if they did require it the probability is that they could not be enforced. This is fully appreciated by those who have charge of their enforcement. The laws usually state that milk shall contain at least 3 per cent of fat; sometimes they prescribe more and sometimes less. Frequently preservatives are prohibited. Legal force is directed principally toward carrying out these requirements. They usually prohibit the sale of impure or adulterated milk or milk from diseased cows, but often they do not define these requirements, and naturally opinions differ upon them. Sometimes they provide for the inspection of producing dairies, but it is seldom that any great part of these are visited and such visits are often only yearly; a little extra attention is usually given to the dairies within city limits. The result is that in many places no attempt whatever is made to enforce sanitary conditions, unless the attention of the authorities is called to an especially flagrant case, which may be dealt with under the general sanitary laws. More satisfactory results of laws may be expected, but they will doubtless come very slowly. The laws may be depended upon to assist materially in raising the average quality of milk, which is extremely desirable, but there will always be a great variation in the units that go to make the average, and consumers who are not reliably posted run the same chance of purchasing from a dairy that is below the average as from one that is above. The laws themselves and the manner in which they are enforced are in great need of

A View in a model Dairy.

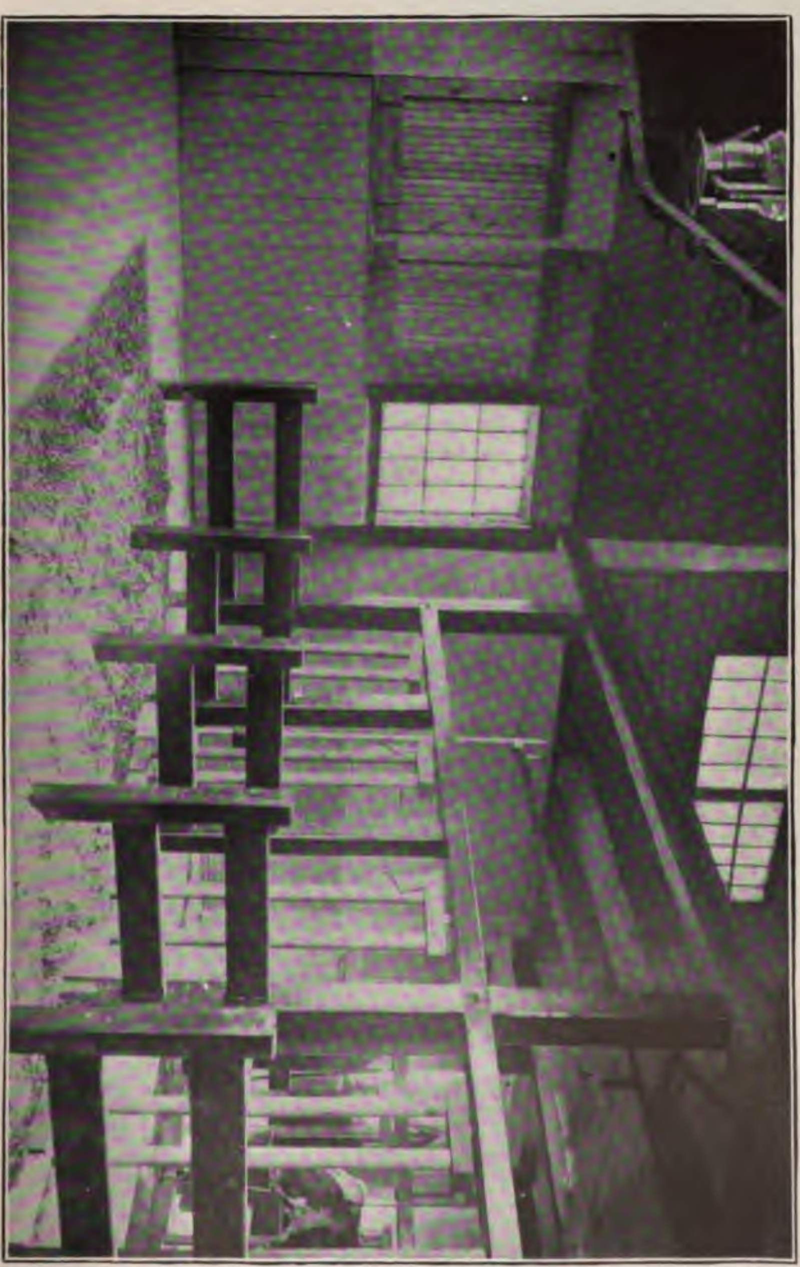


A View in a model Dairy.

PLATE XXXVIII.



A VIEW IN A MODEL DAIRY.



A VIEW IN A MODEL DAIRY.

improvement. Under present conditions they not infrequently have more effect in teaching consumers to avoid milk than in inducing suppliers not to violate their provisions. The public read so many startling reports of diseases among dairy cows and of prosecutions of dishonest milkmen that they do not know what dairyman or dealer to trust; therefore they protect themselves by going without milk. There are thousands of such people in every large city and hundreds in every large town. The statement of a milk inspector that the *worst* dairies have been improved or abolished is not satisfactory to them; for they do not care to run the risk of getting milk even from those next to the worst. As long as they have no way of *knowing* where they can procure pure milk they will use as little as they can.

INDIRECT CONTROL OF DAIRY FARMS.

Some cities which are supplied with milk from neighboring States or other territory over which they have no control have adopted the practical method of requiring all dealers to be licensed to sell milk, and a license will be furnished only when the supply farm is believed to comply with a set of conditions named by the local authorities. The license can be canceled at any time. The conditions are more strict than those usually included in the laws. This method seems to be a step in advance of the one under which officials have no influence over farm conditions. In practice, however, it is found that dairies which are not entitled to them manage to procure licenses.

Such a plan, having been authorized by law, was adopted in a certain large city, and there were great hopes that the question of a pure milk supply was solved. It was found, however, that this was far from being the case. The inspecting force was so small that the more distant dairies were never visited, and the nearby ones but seldom. Permits were given without examination of premises, and the law was so worded that it was a difficult matter to withdraw a permit when once granted. It has not yet been found possible to modify the law, although it was enacted several years ago. It is doubtful if the milk supply of the place referred to is any better than that of the average city.

Another method by which it is proposed that cities shall take matters into their own hands is to inspect all dairy farms and make public reports of the conditions found. Consumers could then be informed as to any dairy farm; the best places would receive some advertisement and others would be exposed. In small cities this method has been quite successful. Dairymen prefer not to have facts unfavorable to them made public. In a New Jersey town the reports include the number of bacteria found in the milk, which is a good index to cleanliness. To be most effective this method would require the printing of frequent reports in such a manner that they would come before the public. But the public knows little about the conditions which should obtain, and it is doubtful if they would profit much generally by the reports. This system would be costly, on account of the large amount of printing; indeed, for this reason, it might be impracticable in cities which are supplied by several hundred farms. Then, too, different inspectors do not look at conditions alike; their ideas as to what is necessary vary with their training, experience, and interests. One might give a dairyman a favorable report when another would severely condemn the same place on account of something which did not meet his approval, though the first inspector attached no importance to it. Thus this scheme may be unjust to the producers. If well directed, however, it will bring about considerable improvement.

METHODS OF PURIFYING MILK.

Several methods of reducing the number of bacteria in milk by removing them or killing them are in use, and some are very efficient. It should not be supposed, however, that milk can, in any way, be made pure after it has once been badly contaminated. These methods are only means for somewhat improving undesirable conditions which should have been prevented. It is much more comfortable to know that the milk one is using never contained objectionable bacteria in any number than it is to be assured that the millions of germs which were recently alive in the cupful of it have all been surely killed, and are therefore quite harmless, or that a large proportion of them have been removed.

Centrifugal separators exert a great force on milk passing through them and remove more or less matter having a specific gravity greater than the body of the milk; this is deposited on the sides of the bowl and is called "slime." This deposit often contains considerable dirt, but it is not wholly dirt or undesirable foreign matter, as many suppose. The quantity of slime is largely influenced by the acidity of the milk and other conditions. Many of the bacteria and much dirt contained in ordinary milk, and which would pass most strainers, are taken out in the slime, but the claim that separators will thus remove all bacteria, or even all pathogenic bacteria, is far from correct. Moore[1] conducted a series of experiments to determine the effect of the separator in removing certain pathogenic bacteria, and found that, although considerable numbers are removed with the slime, some remained in the skimmed milk and cream. Similar results have been reported by foreign investigators.

It has been suggested that bacteria could be removed from milk, as from water, by the process of filtering. But it is impossible to pass milk through a germ-proof filter, because some parts (as, for example, the fat) have substance, or body, even larger than bacteria, and would be held back by the filter. Various results, more or less favorable, of filtering through coarser substances are reported. One writer states that seven-eighths of the microorganisms of milk are removed by passing it through a half-inch layer of compressed absorbent cotton, but another found no beneficial result from such treatment. This material is used with excellent results, however, on many of the best dairy farms; it certainly removes some of the extremely small particles of dirt which succeed in passing through fine strainers of metal or cloth. Such filters should be destroyed after being used once. Milk is also filtered through felt, being forced by pressure, with about the same result as when cotton is used. In some European countries it is run through layers of sand of varying degrees of coarseness, but this method has not been adopted in the United States.

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[1] U. S. Dept. of Agr. Yearbook, 1895, p. 439.

Certain chemicals of a disinfectant nature are sometimes put into milk for the purpose of destroying germ life. Salicylic acid, boracic acid, borax, formalin, and carbonate of soda are the principal reagents used in this way. Their effect on the germs is not as marked as is supposed. As they can be added only in small quantities without detection, but little is used; not enough to destroy the bacteria, but simply to check their growth. Although these substances are not regarded as poisons, they may have an injurious effect on the system when taken continuously in the milk in small doses. A French commission, appointed to investigate the effect of such use of salicylic acid on the public health, reported that the addition of it or its derivatives to food, even in the most minute quantities, should not be permitted. It is asserted that formaldehyde has an adverse effect on the digestibility of casein. It is believed that in general, as these agents are successful in preventing natural fermentations, they will retard digestion in about the same proportions. The danger of preservatives is increased by the fact that they are used by ignorant persons, who think that "if a little is good, more is better," and therefore use them in excess. Another objection is that one accustomed to use preservatives may depend upon them as a substitute for cleanliness. It has been shown that, in regard to certain organic substances, preservatives may check the formation of some of the odoriferous compounds that usually reveal the putrefactive and dangerous condition. Thus, when preservatives are used, ptomaines may be produced without the coincident formation of telltale scents, and the dangerous character of the food may be concealed. The addition of a preservative to milk is dishonest and is rightly considered a dangerous form of adulteration.

The use of high or low pressure, electricity, cold, and ozone in various ways for the destruction of germs in milk have been found ineffective. These agencies are therefore not employed for this purpose, although some of them retard the development of organisms. Everyone knows the effect of cold in this respect. Bacteria are most active at temperatures between 70° and 100° F.; at 50° their growth is much retarded; and below 40° it amounts to practically nothing. Thus far cold is the best known preventive for the increase of germs in milk. But it should be remembered that they are not necessarily killed by cold. Ravenal has shown that some bacteria are not destroyed by exposure to a temperature of 300° F. below zero.

Knowing that all germs are destroyed by sterilization, and the dangers of contagious disease being carried by milk to consumers may be thus avoided, some authorities recommend this treatment for all milk intended for consumption. It is argued that animal foods, as well as others, are cooked before they are eaten, and there is no good reason to make an exception in the case of milk. It is also pointed out that at least a part of the cost of sterilization might be met by the saving of considrable quantities of milk which spoil, from time to time, on the hands of almost every dealer. In order to make sure that the sterilization is thoroughly done, some advocate establishing public plants for the purpose, and requiring every dairyman or dealer to pass his milk through these places before it is sold.

Sterilized milk is rarely sold in American cities; a few companies are prepared to furnish it upon special order, but the demand is very small, and usually only for special cases. Physicians prescribe it for infants suffering from acute intestinal troubles, but its use is rarely continued after recovery. On the other hand, it is commonly used in continental Europe, where many elaborate plants for the sterilization of milk are located. The practice of sterilizing has been adopted there mainly because of the general prevalence of tuberculosis among dairy cows. The positive protection from this disease is supposed to outweigh any disadvantages of the process.

There are several objections to the sterilization of all milk intended for consumption which make the practice undesirable. In the first place, it is by no means a simple process. Bacteria are easily destroyed, as a temperature of about 160° F. is fatal to most of them; but milk may also contain germ spores which are capable of resisting temperatures as high as the boiling point. Bacteriologists report having sterilized small samples of milk and kept them for long periods without change, but it is a difficult and expensive matter to handle large quantities of milk in the same way. For sterilization, which means the destruction of *all* germ life, milk must be heated considerably above the boiling point (the exact temperature depending upon the resisting power of the spores it happens to contain and the time of exposure) and held at this high temperature for several minutes, or it must be treated by the method of intermittent heating. The latter process is expensive, on account of the successive heatings and coolings, and it requires extra provisions for taking care of milk during its treatment, which lasts at least two days. Sterilization, by heating above the boiling point, requires special apparatus and great care. Furthermore, it has unfavorable effects on the appearance, composition, and taste of milk. Leeds and Conn[1] enumerate the following disadvantages of heating milk above the boiling temperature: (1) The germicide power possessed by perfectly fresh milk is destroyed. It is believed that this power affords some protection against pathogenic bacteria which might obtain entrance to milk. (2) The albumen of the milk is coagulated and made less digestible. (3) The starch-fermenting power is lost. It is found that the ferment in the saliva of adults, which converts starch to sugar, is lacking in the saliva of infants; but a similar ferment is present in fresh milk. It would seem to be especially necessary that milk given to infants should not be treated so as to destroy this ferment. (4) Long-continued heating has a marked effect on milk sugar, which is caramelized, forming brown specks in the milk. (5) The condition of the fat is altered by melting, and the globules tend to unite. Thus the fat is made less digestible, as it must again be emulsified before it can be digested. (6) The casein is also affected, as is shown by the fact that it requires a larger amount of rennet for its precipitation, and is less readily acted upon by pepsin and pancreatin than casein of raw milk. The authors state that sterilized milk is not a natural product; indeed, "it is *not milk*," and they refer to experiments which show that it is not so easily digested as raw milk. Its use for feeding infants in the Philadelphia Hospital is reported by Dr. Davis,[2] who found that abnormal symptoms appeared in some of the young patients, and in some cases they died, apparently from starvation. Opposite results, however, have been obtained in foreign cities. This question needs further study.

Pasteurization of milk has more advocates than sterilization. These two terms are incorrectly used as meaning the same thing, when in fact the operations differ essentially. Pasteurization is not an exact operation, but results in the destruction of many bacteria, the efficiency depending upon the degree of heat and length of exposure to it. Milk containing many thousand bacteria per cubic centimeter may have the number reduced to less than 100 by subjecting it to 156° for thirty minutes, and its keeping quality is much improved.

Authorities differ somewhat as to the exact temperatures and lengths of exposures to heat necessary to destroy the germs of tuberculosis, typhoid fever, and diphtheria—the diseases most commonly carried by milk—but it is generally agreed that 150° F. for thirty minutes is fatal to them, and recent investigations by Russell show that when milk is pasteurized in a closed receptacle, 140° F. for 20 minutes is sufficient. This latter degree of heat does not affect the composition and appearance of milk. Besides the destruction of the kinds of bacteria named, if present, large numbers of souring and putrefactive bacteria are also killed, and the keeping quality of the milk is thus improved.

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[1] Report of N. J. Dairy Commission, 1891.

[2] Am. Jour. Med. Sci., 1891.

The operation of pasteurizing milk is comparatively simple and easy; it can be done without elaborate apparatus and is not necessarily expensive, but it requires great care.

The pasteurization of all milk is often recommended, and there is no doubt that much of the milk sold in cities would be improved by this treatment. The pasteurized article is found in the market of most cities and it is often sold at retail at an advance over the price of raw milk. But it is not generally favored, and its popularity does not seem to be on the increase. This is partly because it is too often heated so high as to cause a disagreeable cooked flavor. A few dealers consider the advantages of pasteurized milk so great that they thus treat almost their entire output, taking great care always to avoid cooked flavor, and customers use it thinking it raw.

Some of the objections to sterilized milk apply equally to pasteurized milk, but one practical objection to the pasteurization of milk for the improvement of its sanitary condition will be given. Bacteriologists state that when several species of bacteria are growing in the same medium, some may retard or prevent the growth of others. When milk is pasteurized the most numerous forms of bacteria are killed. This may give a chance for some dangerous forms, which have been previously restricted, to multiply rapidly and with serious results. It is known that among the germs which are not destroyed at the usual pasteurizing temperature are some which, if in sufficient numbers, cause intestinal troubles in infants. Flugge[1] found that the bacteria of infantile diarrhea are not killed by boiling. He found four anaerobic bacilli and twelve aerobic bacilli in milk which had been heated to 95° C. All had spores which resisted boiling for two hours. (The aerobic organisms form compounds which cause diarrhea.) He takes the extreme ground that sterilized (pasteurized?) milk should be prohibited by law. It may be argued that the multiplication of these germs can be prevented by reducing the milk to a low temperature after boiling and holding it so, but it is doubtful if this would be done by people who could not *see* the benefits of keeping the milk cold.

Upon the whole, the expediency of pasteurization as well as sterilization of milk, except in special and exceptional cases, may be considered doubtful. The entire subject requires further and most painstaking investigation.

For practically all consumers the thing most to be desired is absolutely natural milk, as produced by the healthy cows, good, pure, and safe. Such milk can be reliably obtained by adopting the plan explained and recommended herein.

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[1] Abstr. Analyst, 1896, p. 102.

APPENDIX I.

One of the few milk commissions in operation is located in Philadelphia, Pa., and its work, which commenced only recently, has thus far been very satisfactory. It now indorses the milk from four dairies, and it is said that this number will be increased in the near future. The milk from these dairies sells for 12 cents per quart. The members of the commission are appointed by the Philadelphia Pediatric Society, and reports are made to that organization. Dr. Alfred Hand, jr., is secretary of the commission. A recent report of the commission[1] follows, together with copies of circulars which the commission uses, for distribution to dairymen selling milk in Philadelphia, of the form of contract with dairymen, and of the forms of the reports by the experts of the commission:

Report of the Milk Commission of the Philadelphia Pediatric Society.

The milk commission of the Philadelphia Pediatric Society was appointed at a meeting held on January 10, 1899. Since then the commission has made from time to time informal reports upon its work, but it has been unable to present any definite results until the present time. The reasons for this apparent delay are many. In the first place, the plan formulated by the commission and approved by the society differs in many respects from that adopted by other bodies, aiming at the improvement of the milk supply for infants and for general consumption. So far as we have been able to find, there is no commission in any city with powers exactly similar to those with which you have invested your commission. Consequently our plans had to be originated *de novo*, and needed correction from time to time.

After consulting the available literature regarding similar work in other cities, and after considerable correspondence with those capable of giving the commission information, the details of the plan were gradually evolved after many meetings and with repeated revision and corrections. The general plan being agreed upon, legal advice was sought as to our rights and powers and in regard to what measures should be taken in order that successful applicants for our certificates might be protected from fraud upon the part of those not meeting our requirements. Numerous conferences were then held with various dairymen of approved standing in order to determine whether our methods could be practically employed. It was not until these steps had been taken that the members of the commission felt that their ideas were sufficiently well established to undertake the actual practical work devolving upon them. During the early spring of this year the commission felt that it was prepared to offer to dairymen the opportunity for expert examination of their milk and cream. This was done by addressing printed circulars setting forth the objects and proposed methods of the commission to a large number of milk producers. As a result of this, many requests for information were received, and a considerable amount of correspondence was made necessary, especially in regard to the limit of fat in milk allowed by the commission. The commission heard the various suggestions made, and, while adhering to the essentials of their plan, made some slight modifications which they deemed advisable in order that the greatest number of infants might be benefited.

A summary of the articles of agreement with the dairymen is as follows: The commission appoints experts to examine the dairy and its products in regard to the health of the cows, the cleanliness of the stables, milk room, and apparatus, and the health of the employees; also in regard to the chemical composition and purity of the milk, and the number and kinds of bacteria present. The commission grants or refuses certificates in accordance with the result of the experts' examination. These certificates are in such form that they can be handed to the consumer with each bottle of milk or cream. The dairyman agrees to abide by the decisions of the commission and to pay for the examinations.

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[1] Published in the Philadelphia Medical Journal, Vol. VI, No. 16, October 20, 1900.

The procedures so far followed have been, first, that the agreements have been signed when the dairymen notified the commission that they wished to have their dairy examined. The commission, when so notified, instructs its experts to examine the dairy and its products. The experts then report to the commission on blanks provided for that purpose, and finally, where the examination has shown the proper conditions to be present, certificates have been issued in accordance with the contract. At the present time the dairies which have applied for and been successful in obtaining the certificate of the commission are the following:

* * * * * * *

As the result of action thus far, others are being stimulated to improve their dairies so as to enable them to obtain the certificate of the commission. It does not seem too much to hope that ultimately the whole milk supply of the city may be improved, owing to the demonstration of the practicability of such improvement and to the demand for certified good milk that will surely follow the education of the public.

With this report the commission presents for your inspection the various circulars, contracts, blanks for experts' reports and certificates which they are putting in use at the present time. All of which is respectfully submitted.

[Signed by the chairman and four other members of the commission.]

Circular letter to dairymen.

Dear Sir: As will be seen by the accompanying circular, the Philadelphia Pediatric Society (which has for its object the study of diseases of children) has appointed a committee of its members, whose duty it shall be to take certain measures to facilitate the question of infant feeding. The society is anxious to provide some method by which physicians can know the strength and purity of the milk and cream used in making up the bottles for babies.

If you desire to have the milk of your dairy so examined and certified, you can do so by applying by mail to the secretary of the milk commission.

If you do not wish to have your milk so examined, the commission does nothing prejudicial to your interests; but it is believed that it would be to the advantage of the physicians and the better class of milk producers to have some such method of examination under the supervision of a committee appointed by a society composed of physicians interested in the welfare and treatment of children. In no other way could a certificate be obtained that would be of so much value to all interested.

Milk Commission, Philadelphia Pediatric Society.

Circular of information.

1. There shall be a milk commission of the Philadelphia Pediatric Society, whose duty it shall be to have examined milk submitted to them by dairymen and certify as to the result of such examination.

2. The actions of the commission shall be reported from time to time to the society and shall be subject to its approval.

3. The commission shall consist of four members besides the president of the society, who shall be a member ex officio. The members shall be appointed yearly by the president as soon as possible after his election. The commission shall elect a chairman and a secretary from their number.

4. No statement for publication or information to any dairyman shall be given by

or in the name of any individual member, but only after consideration by the commission and in the name of "The Milk Commission of the Philadelphia Pediatric Society."

5. The commission will hold itself in readiness to examine milk from dairies desiring this examination, and to certify to the good quality of milk which comes up to the standards fixed by it. It is understood that only the milk of dairies, and not that of milkmen who merely serve milk bought by them, will be examined by the commission.

6. The method of examination and certification to which the dairyman or his agent shall agree to submit shall be as follows:

7. The commission shall select a bacteriologist, a chemist, and a veterinary inspector. The bacteriologist shall procure a specimen of milk from the dairy, or, preferably, from delivery wagons, at intervals to be arranged between the commission and the dairy, but in no case at a longer interval than one month. The exact time of the procuring shall be without previous notice to the dairy. He shall test this milk for the number and nature of bacteria present in it, to the extent which the needs of safe milk demand. He shall also make a microscopic examination of the milk for pus cells. Milk free from pus and injurious germs and having not more than 10,000 germs of any kind or kinds to the cubic centimeter shall be considered to be up to the required standard of purity.

8. The chemist shall in a similar manner procure and examine the milk for the percentages of proteids, fat, sugar, mineral matter, and water present. He shall also test its chemical reaction and specific gravity, and shall examine it for the presence of foreign coloring or other matters or chemicals added as preservatives. Standard milk shall range from 1.029 to 1.034 specific gravity, be neutral or very faintly acid in reaction, contain not less than from 3.5 per cent to 4.5 per cent proteid; from 4 to 5 per cent sugar, and not less than 3.5 to 4.5 per cent fat, and shall be free from all contaminating foreign matter and from all addition of chemical substances or coloring matters. Richness of cream in fat shall be specified and shall vary not more than 1 per cent above or below the figure named in selling. Neither milk nor cream shall have been subjected to heat before the examination has been made, nor at any time unless so announced to the consumer.

9. The veterinary inspector shall, at intervals equal to those of the bacteriologist and chemist, and without previous warning to the dairy, inspect the cleanliness of the dairy in general, the care and cleanliness observed in milking, the care of the various utensils employed, the nature and quality of the food used, and all other matters of a hygienic nature bearing upon the health of the cows and the cleanliness of the milk, including also so far as possible the inquiry into the health of the employees on their farms. He shall also see that the cows are free from tuberculosis or other disease.

10. The charges made by the experts shall be: For the veterinarian $10, and $5 for each of the others, for each examination; this amount to be paid by the dairy at the time of the examination and without regard to whether the report is favorable or unfavorable. The experts shall make their examinations when, and only when, notified to do so by the commission. Any dairy the milk of which shall be found by the examiners to be up to the standard of the commission shall receive a certificate from the commission, which shall read as follows:

MILK COMMISSION OF THE PHILADELPHIA PEDIATRIC SOCIETY.

Date ——— ———.

The veterinary inspector of the commission has examined the dairy of Mr. ——— ——— and reports it to be well kept and clean, and the cows to be in a healthy condition.

The bacteriologist reports that the milk does not contain germs beyond the limits of the standards of the commission.

The chemist reports that the milk is of standard richness, and that he has discovered in it no impurities, coloring matters, chemical preservatives, or harmful substances.

The commission certifies to these statements of the examiners. It is understood and agreed to by the said Mr. ——— ——— that this certificate is good for not more than ——— ——— from date, when another examination is to be made.

[Signed by the commission.]

11. In case an examination shows the milk not up to the standard, the dairy may have a reexamination made within a week or within a short time, at the discretion of the commission.

12. The commission for 1900 have selected—

As veterinary inspector, Dr. ——— ———.

As bacteriologist, Dr. ——— ———.

As chemist, Dr. ——— ———.

13. Milk furnished by the dealers to whom certificates have been issued shall be furnished to consumers in glass bottles hermetically sealed in a manner satisfactory to the commission. In addition to the sealing, and as a guaranty to the consumer that the examination has been regularly conducted, there shall be pas'ed over the mouth of the jar or handed to the consumer with every jar, according to the discretion of the commission, a certificate slip which shall read as follows:

MILK COMMISSION OF THE PHILADELPHIA PEDIATRIC SOCIETY.

——— ———.

Milk from the dairy of Mr. ——— ——— has been recently examined by the experts of the milk commission and found to be fully up to the required standards. Another examination is to be made within a month, and, if satisfactory, new labels for the bottles will be issued, dated ——— ———.

Notice the dates.

Form of Contract.

Articles of agreement entered into this —— day of ———, 1900, between the milk commission of the Philadelphia Pediatric Society of the first part and ——— ———, of ——— ———, of the second part.

It is agreed by the said parties that these articles of agreement shall continue for a period of ——— ——— from date.

The party of the second part agrees that the party of the first part shall procure a bacteriologist, a chemist, and a veterinary inspector; the bacteriologist to procure a specimen of the milk, either from the dairy or delivery wagon of said party of the second part, whenever the said party of the first part sees fit, at intervals of approximately one month, the time of procuring said milk to be without notice to the said party of the second part; which bacteriologist shall test said milk for the number and nature of bacteria present to the extent which the needs of safe milk demand, and to make a microscopic examination for pus cells and injurious germs. It is also agreed by the parties hereto that the required standard of purity shall be milk free from pus or injurious germs and having not more than ten thousand germs of any kind or kinds to the cubic centimeter.

It is agreed by the said party of the second part that the chemist of the party of the first part shall examine said milk for the percentages of proteids, fat, sugar, mineral matter, and water present; shall test its chemical reaction and specific gravity, and shall examine it for the presence of foreign coloring or other matters or chemicals added as preservatives. It is agreed by both parties that the required standard shall range from 1.029 to 1.034 specific gravity, be neutral or very faintly acid in reaction, contain not less than from 3.5 per cent to 4.5 per cent proteid, from 4 per cent to 5 per cent sugar, and not less than 3.5 per cent to 4.5 per cent fat (milk of a higher percentage to be so specified on each bottle), and shall be free from all contaminating foreign matter and from all additions of chemical substances or coloring matters; that richness of cream in fat shall be specified, and shall vary not more than 1 per cent above or below the figure named, and that neither milk nor cream shall have been subjected to heat before the examination nor shall be at any time unless so announced to the consumer.

It is agreed by both parties that the veterinary inspector shall at intervals equal to those of the bacteriologist and chemist, and without previous warning to the party of the second part or his agents, inspect the cleanliness of the dairy in general, the care and cleanliness observed in milking, the care of the various utensils employed, the nature and quality of the food used, and all other matters of a hygienic nature bearing upon the health of the cows and the cleanliness of the milk, including so far as possible the inquiry into the health of the employees in and about the dairies; and that he shall see that the cows are free from tuberculosis or other diseases.

It is also agreed by both parties that charges shall be made by each of the experts not to exceed $10 for each examination, which amount is to be paid by the party of the second part at the time of examination and without reference to whether the report is favorable or otherwise.

It is agreed that all examinations by the experts shall be made only upon instruction by party of the first part.

It is agreed by both parties that if the examinations as aforesaid find the milk up to the aforesaid required standards, the said party of the first part shall give a certificate to said party of the second part as follows:

MILK COMMISSION OF THE PHILADELPHIA PEDIATRIC SOCIETY.

Date ——— ———.

> The veterinary inspector of this commission has examined the dairy of ——— ——— and reports it to be well kept and clean and the cows to be in a healthy condition.
>
> The bacteriologist reports the milk free from germs within the limits of the standards of the commission.
>
> The chemist reports that the milk is of standard richness and that he has discovered no impurities, coloring matters, chemical preservatives, or harmful substances.
>
> The commission certifies to these statements of the examiners, it being understood, however, that this certificate is good for only one month from date.
>
> [Signed by the commission.]

It is further agreed by both parties hereto that in case an examination shows the milk not to be up to the required standard that said party of the second part may have another examination made within a short time at the direction of the commission.

It is agreed by the party of the second part that the milk furnished by him to dealers shall be in glass jars hermetically sealed in a manner satisfactory to the party of the first part, and as a guaranty to the consumer that the examination has been regularly conducted he shall paste over the mouth of each jar or give to the consumer with every jar a label similar to the following:

MILK COMMISSION OF THE PHILADELPHIA PEDIATRIC SOCIETY.

Date ——— ———.

Milk from the dairy of ——— ——— has been recently examined by the inspectors of this commission and found of the required standard.

This certificate is good for only one month.

MILK COMMISSION OF THE PHILADELPHIA PEDIATRIC SOCIETY.

It is further agreed by the said party of the second part that this agreement is entered into by the parties hereto solely at the request of said party of the second part, that no liability shall accrue to said party of the first part except or beyond that expressly stated in these articles of agreement, and that he, the said party of the second part, will assume all risk and be liable for any complaint alleged to be traceable to the examinations, issuance of certificate, and labels aforesaid.

In testimony whereof the parties hereto have hereunto set their hands and seals the date aforesaid.

——— ———. [SEAL.]
——— ———. [SEAL.]

The following is a copy of the label for glass jars which has been found to be most satisfactory after the trial of several forms:

PHILADELPHIA PEDIATRIC SOCIETY—MILK COMMISSION CERTIFICATE, OCTOBER 10, 1900.

Milk from the dairy of John Jones has been recently examined by the experts of the Milk Commission and found to be up to the required standards. Another examination will be made within a month and, if satisfactory, new labels for the bottles will be issued, dated November 10, 1900.

Notice the dates.

P. P. S. MILK COMMISSION.

This label is printed on a piece of paper 2¼ inches long and 1¼ inches wide, bearing a large copyrighted monogram of the commission on top of the printing. It is folded once and laid on the cap, being held in place by an outer tin-foil cap which completely covers the top of the jar. In some cases paraffin is used to cover the pasteboard cap which closes the jar.

Form for Veterinarian's Report.

MILK COMMISSION—PHILADELPHIA PEDIATRIC SOCIETY—REPORT OF VETERINARIAN.

PHILADELPHIA, ——— ———, 190—.

Secretary of the Milk Commission.

DEAR SIR: I have examined, as requested by the commission, the dairy of ——— ———, at ——— ———, and find the following conditions:

I. ——— milking cows.
——— hospital cows.
——— dry cows.
——— cows added since last report.

—— cows now in quarantine.
—— cows recently calved.
—— cows sick since last report.

Total number of cows in herd ——, of which —— have been tested with tuberculin.

II. Condition of milch cows at present, good.

III. Food employed.

IV. Condition of stables.
Ventilation ——. Heat ——.
Floors ——. Troughs ——.
Cleanliness, etc., ——.
Dimensions of stables ——.
Condition of other buildings, good.

V. Health of employees and their families, so far as ascertained, is good.

VI. Source and character of water in dairy and stables.

VII. The general precautions of cleanliness in milking and the care of the milk are satisfactory.

I therefore recommend that milk from this dairy be submitted to the bacteriologist and chemist of the commission for their examinations.

Yours, truly,

—— ——, V. M. D., *Veterinarian.*

Form for Bacteriologist's Report.

MILK COMMISSION—PHILADELPHIA PEDIATRIC SOCIETY—REPORT OF BACTERIOLOGIST.

PHILADELPHIA, —— ——, *190—*.

Secretary of the Commission.

DEAR SIR: At the request of the commission, received on ——, 190—, milk from the dairy of —— ——, labeled —— ——, was obtained by me on ——, 190—, at —— —— street, at —— o'clock — m., and examined at —— o'clock — m., with the following results:

Number of bacteria per c. c. of milk, ——.

I have been unable to detect any pathogenic organisms or evidence of purulent inflammation of the udder.

I therefore recommend the milk as coming up to the bacteriologic standards adopted by the commission.

I find the milk bottles to be sealed in the manner prescribed by the commission.

Yours, truly,

—— ——, *Bacteriologist.*

Form for Chemist's Report.

MILK COMMISSION—PHILADELPHIA PEDIATRIC SOCIETY—REPORT OF CHEMIST.

PHILADELPHIA, ——— ———, 190—.

Secretary of the Commission.

DEAR SIR: At the request of the commission, received on ———, 190—, milk from the dairy of ——— ———, labeled ——— ———, was obtained by me on ———, 189—, at ——— ——— street, at —— o'clock — m., and examined at —— o'clock — m., with the following results:

Total solids (by evaporation of weighed amount in platinum basin), ———.

Fat (Leffmann-Beam method), ———.

Ash (by burning off solids obtained as above), ———.

Total proteids (Kjeldahl-Gunning method, factor 6.25), ———.

Preservatives and added color, none.

Specific gravity, ———.

I therefore recommend the milk as coming up to the chemical standards adopted by the commission.

I find the milk bottles to be sealed in the manner prescribed by the commission.

Yours, truly,

——— ———, *Chemist.*

When the commission wishes to have an examination made a postal card, like the following, is sent to the expert:

PHILADELPHIA PEDIATRIC SOCIETY—MILK COMMISSION.

Dr. ——— ———.

DEAR DOCTOR: Please examine $\left\{\begin{matrix}\text{milk}\\ \text{dairy}\end{matrix}\right\}$ of

———————————— at ————————————

———————————— at ————————————

———————————— at ————————————

———————————— at ————————————

and send me your report at your earliest convenience.

Yours, truly,

SECRETARY OF THE MILK COMMISSION,
PHILADELPHIA PEDIATRIC SOCIETY.

APPENDIX II.

Within the past few months a milk commission has been created in New York City by the Medical Society of the County. Dr. Henry Dwight Chapin is its chairman, and he reports an encouraging beginning. Four dealers are now handling milk that is up to the standard set by the commission and others are trying to improve their product so as to earn its approval. The price per quart charged by different dealers for milk thus "certified" varies from 10 to 15 cents.

A circular of general information issued by the commission follows:

The Milk Commission of the Medical Society of the County of New York.

The commission appointed by the New York County Medical Society to improve the milk supply of New York invites the milk dealers to cooperate with them in this work.

This commission feels that the milk dealers equally with themselves are interested in the question of milk supply, hence their cooperation and advice is earnestly requested.

It has seemed wise to the commission to offer certain suggestions to the milk dealers who wish to cooperate with them in securing a high grade of clean milk. It is believed that much can be done to secure a cleaner milk for New York. The following suggestions, adapted from the fifty dairy rules of the United States Department of Agriculture, are recommended for strict adoption in our dairies. The milk dealer may refuse to procure milk from any dairy that has not carried out strictly these suggestions.

The subject can be divided into the care of stable, of the cows, milking, and the care of the milk.

1. The stable.—Keep dairy cattle in a room or building by themselves. It is preferable, when possible, to have no cellar below and no storage loft above. The stables should be well ventilated, lighted, drained; should have tight floors and walls, and be plainly constructed. Store the manure under cover outside the cow stable, and remove it to a distance as often as practicable. Whitewash the stables once or twice a year; use land plaster in the manure gutters daily; clean and thoroughly air the stable before milking; in hot weather sprinkle the floor.

2. The cows.—Have the herd examined at least twice a year by a skilled veterinarian. Promptly remove from the herd any animal suspected of being in bad health and reject her milk. Never add an animal to the herd until certain it is free from disease, especially tuberculosis. Do not allow the cows to be excited by hard driving, abuse, loud talking, or any unnecessary disturbance. Feed liberally, and use only fresh, palatable food stuffs. Provide water in abundance, easy of access, and always pure. Do not allow any strongly flavored food, like garlic, cabbage, turnips, to be eaten except immediately after milking. Clean the entire body of the cow daily. If the hair in the region of the udder is not easily kept clean, it should be clipped. If the sides of the cow are plastered with dirt or manure, as is often the case, a certain amount is sure to fall into the pail of milk. This is where the trouble really begins, for this dirt and manure abound in bacteria which cause decomposition in milk and thereby induce bowel disturbances.

3. The milk.—The milker should be clean in all respects. He should wash and dry his hands and clean his nails just before milking. After the hands have been washed, a little vaseline may be used on them, thereby preventing scales from the teat or fingers getting into the milk. The milker should wear clean, dry garments, used only when milking, and kept in a clean place at other times. Brush the udder and surrounding parts just before milking, and wipe them with a clean, damp cloth or sponge. Commence milking at the same hour every morning and evening, and milk quietly and thoroughly. Throw away (but not on the floor—better in the gutter) the first few streams from each teat. This first milk is watery and of little value, and during the intervals between milking the bacteria from the air get into the cow's teats and grow with great rapidity. These bacteria cause early souring of the milk. If in any milking a part of the milk is bloody or stringy or unnatural in appearance, the whole mass should be rejected. Milk with dry hands, or oiled as above; never allow the hands to come in contact with the milk. If any accident occurs by which the pailfull, or partly full, of milk becomes dirty, do not try to remove this by straining, but reject all this milk and rinse the pail.

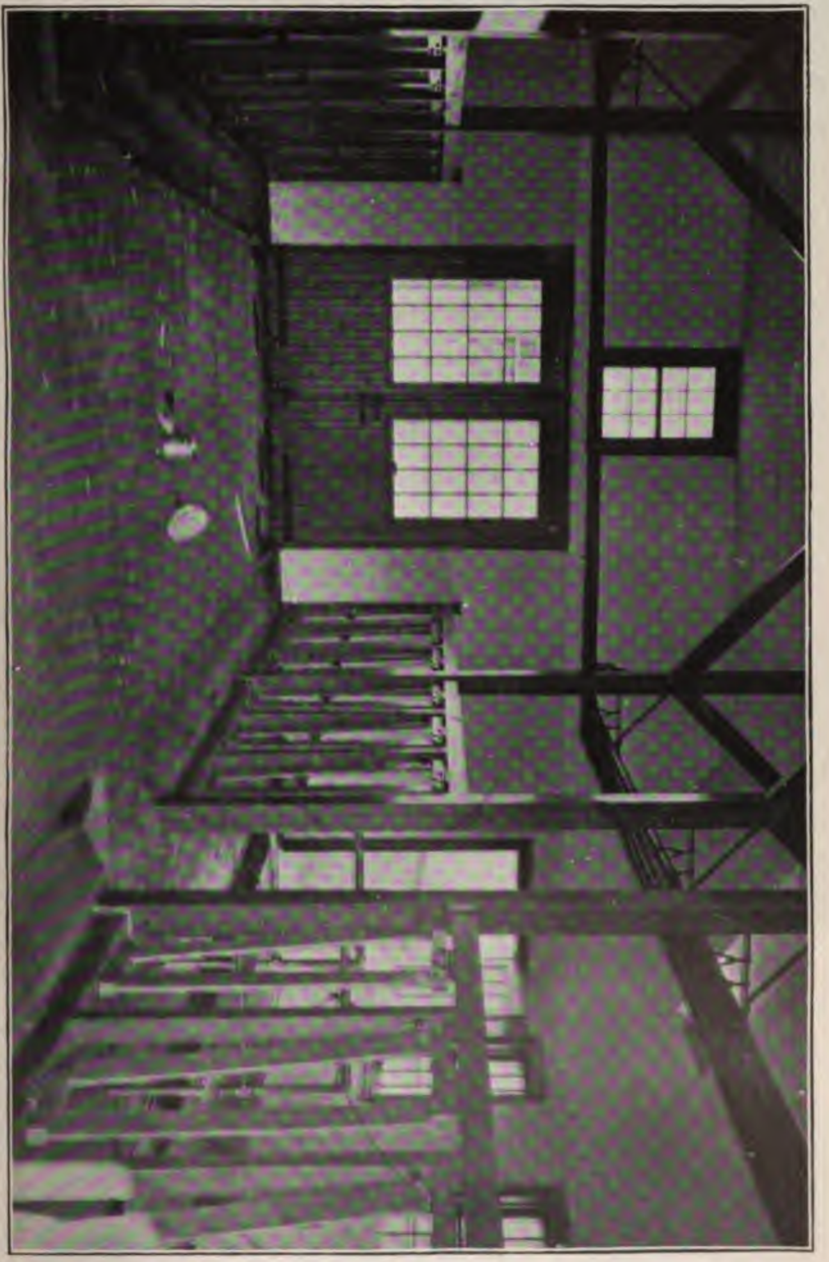
4. Care of the milk.—Remove the milk of every cow from the dairy at once to a clean, dry room, where the air is pure and sweet. Do not allow cans to remain in stables while they are being filled. Strain the milk through a metal gauze and a flannel cloth, or layer of cotton, as soon as it is drawn. Aerate and cool the milk as soon as strained. The rapid aeration and cooling of milk are matters of great importance. Combined aerators and coolers, suitable for use with well water or ice water, can be had at any dairy supply house at a small cost. By using one of these, the cow odor, the animal heat, and much of the dirt can be removed from milk in a few minutes. The milk should be cooled to 45° F., if for shipment, or to 60° F., if for home use or delivery to a factory. Never mix fresh, warm milk with that which has been cooled. Do not allow the milk to freeze. When cans are hauled a distance they should be full and carried in a spring wagon. In hot weather cover the cans, when moved in a wagon, with a clean wet blanket or canvas. If milk is stored, it should be held in tanks of fresh, cold water, renewed daily, in a clean, cold, dry room. Clean all dairy utensils by first thoroughly rinsing them in warm water; then clean inside and out with a brush and hot water into which a cleansing material is dissolved; then rinse, and lastly sterilize by boiling water or steam. Use pure water only. After cleaning, keep the utensils inverted in pure air and sun if possible, until wanted for use. Old cans in which parts of the tin are worn off, or where there are seams and cracks, are impossible to keep clean, and should not be employed.

If precautions like the above are strictly carried out, the milk will be clean and remain fresh for a considerable length of time. The fresher the milk is the better it will be for family use. The test of uncleanliness consists in an increase in the proportion of lactic acid generated in the milk and in a large increase in the number of bacteria per cubic centimeter.

The milk commission of the New York County Medical Society agrees to guarantee or certify the milk of all dealers desiring such certificate. A special label will be furnished for this purpose. The standard required to obtain this indorsement will be that the acidity must not be higher than 0.2 per cent, and that the milk must not contain more than 30,000 germs, or bacteria of any kind, to the cubic centimeter. This will be tentatively adopted as a standard of clean milk, as bacteria get into the milk through lack of cleanliness during the milking, and careless handling of the milk after the milking, and hence is a good clue to the care bestowed in the production and general handling of milk. The milk, before testing, must be in its natural state, not having been heated, and without the addition of coloring matter or preservatives. The butter fat must reach 3.5 per cent. Examinations must be made by the experts retained by the commission, with a frequency at their option, according to the season and the general condition of the milk under inspection, and at least once a month. The commission reserves the right to change its standard, in any reasonable manner, upon due notice being given to the dealer. The expense of the examination will be met by the dealer. All reports of examinations will be strictly confidential between the commission and the individual dealer.

(Signed by the chairman and three other members of the commission.)

Inspections for the commission are made by the veterinarians and other experts of the city board of health. Jars containing approved milk are closed with caps printed "Milk Commission—Medical Society, County of N. Y.—Certified."



A Dairy Barn, showing Stanchions.

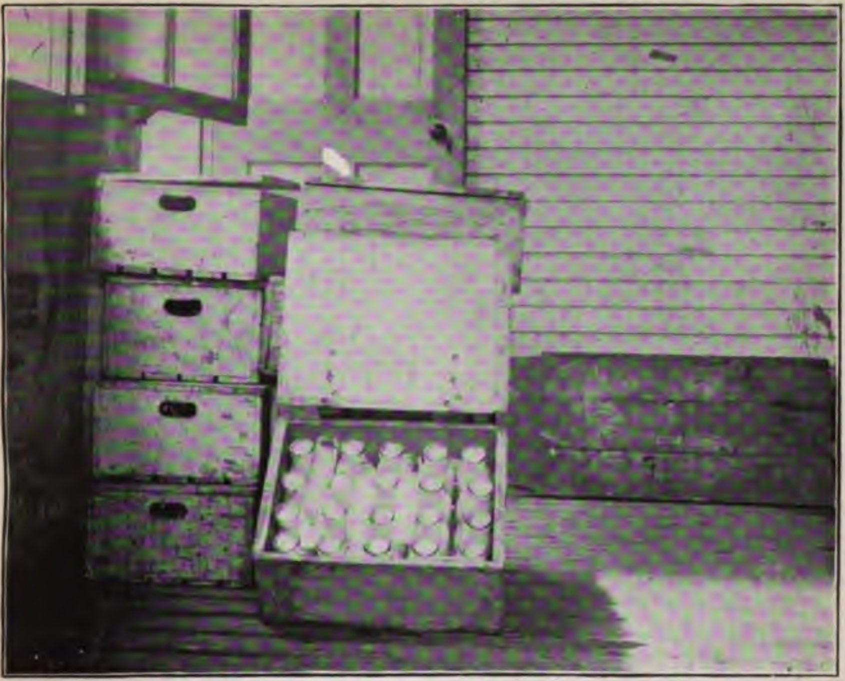


FIG. 1.—MILK BOTTLED FOR SHIPMENT.

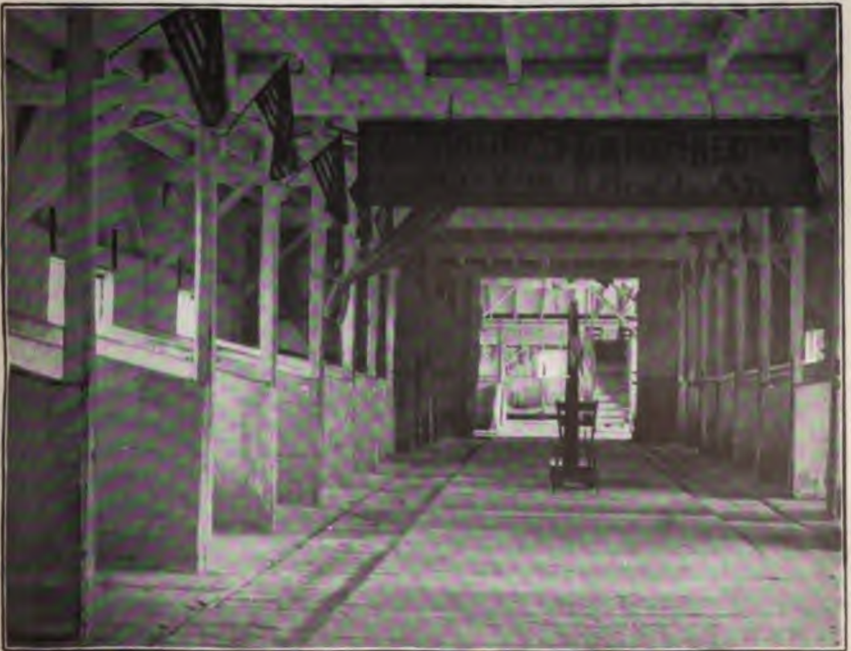


FIG. 2.—DAIRY BARN, SHOWING WHITEWASHED STALLS.

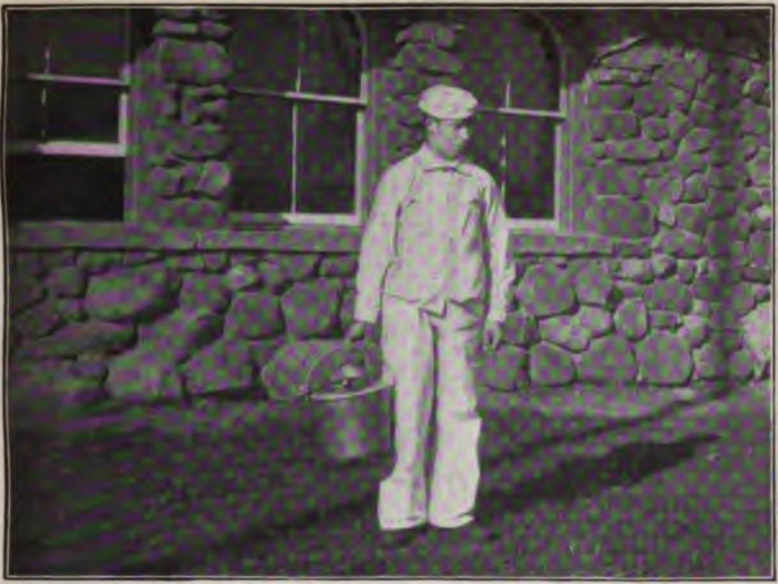


FIG. 1.—DAIRYMAN WITH PATENT MILK BUCKET.

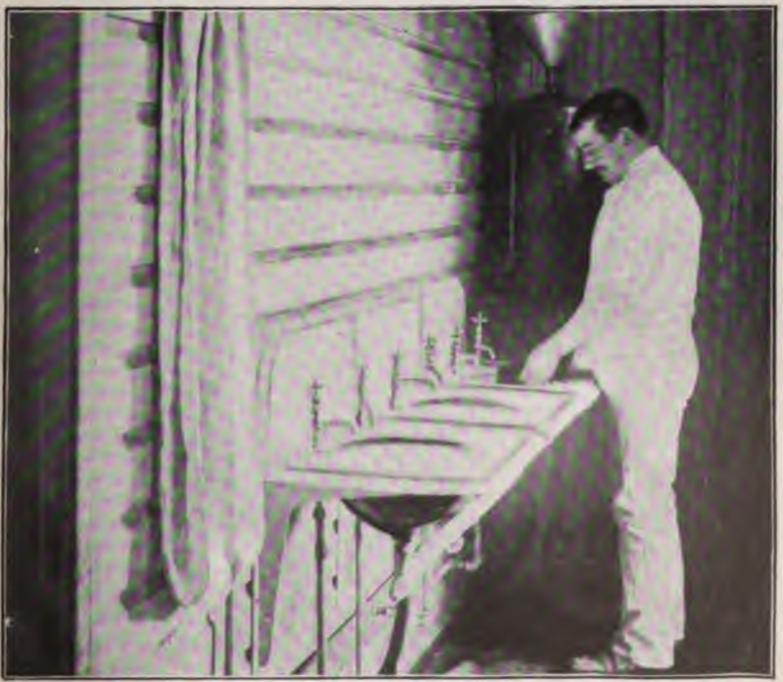


FIG. 2.—WASH ROOM IN DAIRY BARN.

Of interest in this connection is the following copy of an advertising circular of one of the dealers whose milk is indorsed by the commission. It shows how those in the milk business can make good use of the commission's indorsement in securing new trade.

——————————'s

Guaranteed Milk.

"CERTIFIED"

by the

MILK COMMISSION

of the

Medical Society of the County of New York.

——— ——— desire to announce that they are now prepared to supply *guaranteed milk* "certified" by the above commission, who repeatedly have the milk examined bacteriologically, as well as the condition of the barn and methods under which this milk is produced, which milk is designed as a superior product for cases of sickness, and especially for *children and nursery uses.* Twelve cents per quart.

Inspection of the farms invited.

Offices at ——— ———.

DAIRY PRODUCTS AT THE PARIS EXPOSITION OF 1900.

By HENRY E. ALVORD, C. E.,[1]
Chief of the Dairy Division, Bureau of Animal Industry.

The dairy industry was given a prominent place in the agricultural section of the Universal Exposition at Paris in the year 1900. The following-named countries were represented in the exhibits in this class, and the relative extent and importance of their contributions were, approximately, in the order stated: France (800), Switzerland (160), United States (152), Russia (100), Belgium (60), Denmark (35), Holland (32), Germany (30), Great Britain (28), Canada (?), Italy (21), Portugal (13), French colonies (12), Bulgaria (10), Mexico (9), Luxembourg, Hungary, Spain, Austria, Greece, and the Republic of San Marino. Sweden is the notable omission from this list. The figures in parentheses following the names indicate the number of separate entries of all kinds made by the respective countries. As hereafter explained, some countries exhibited almost exclusively a single kind of product, while others contributed more or less variety. Every conceivable kind of dairy product was on exhibition from one source or another.

This branch of the exhibit was divided into two distinct parts: First, the imperishable articles, which were included in the permanent exhibits of the various countries in the "Palace of Agriculture" at the Champ de Mars; and second, the perishable products—milk, cream, butter, and cheese—which were contributed to three special and temporary "concours," or shows, held in the months of May, July, and September, each for one week.

The first part comprised, as a rule, such things as condensed milk in sealed packages, sterilized milk in bottles, and butter and cheese in airtight cans; also models of butter and cheese in various forms and commercial packages, with pictures, maps, charts, statistics, etc., illustrating the condition of the industry, production, varieties, and markets. The United States was the only country which attempted to maintain a continuous exhibit of fresh dairy products. This was made possible by having a large display refrigerator, which was one of the most prominent features of the American agricultural section, and by the efforts of this Department, which, in connection with its experimental exports for the year, furnished constant supplies of fresh products. There were thus to be seen throughout the Exposition sample commercial packages of various styles of the finest butter and cheese from creameries, farms, and factories in all parts of this country. Fresh arrivals enabled renewals and changes to be made fortnightly, and these frequently included natural milk and cream from noted American dairies. In the French section two local companies maintained dairy-lunch booths, with constant fresh supplies of milk and cream, and a few others kept pasteurized and sterilized milk on exhibit. There were also daily demonstrations during the greater part of the Exposition of making butter and Gruyère cheese by syndicates of French cooperative creameries and cheese factories. But there were no collections or general displays of fresh dairy products in the Exposition proper from France or any other foreign country.

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[1] Major Alvord was detailed from the Department of Agriculture as expert for the United States Paris Commission, in charge of the dairy exhibit of the United States at the Exposition of 1900, and was also a member and vice-president of the international jury for class 40, dairy products, etc.

The three temporary shows of dairy products were held in the inclosure of the Exposition annex in the park of Vincennes. This was 7 or 8 miles up the Seine from the main Exposition, outside the city limits, and a very inaccessible place. It required a full hour to make the journey from any part of the regular Exposition to this annex. When reached, the location and accommodations were alike unsuited to the purpose. Upon the shore of a dirty sheet of stagnant water, called by courtesy the "lake" of the Bois de Vincennes, a dairy pavilion was constructed by erecting a skeleton frame and covering it with canvas. This temporary shelter, standing upon low, moist ground, with bad air and unfavorable surroundings, failed to keep out storms on the one hand, and on the other it became a veritable oven on a bright summer day. In this framed tent the delicate dairy products were exposed day after day upon open tables with no protection whatever. Conditions could not have been much worse. To this distant and inconvenient place the products had to be moved from the storage and regular agricultural exhibit quarters at the Champ de Mars, passing two sets of customs and *octroi* (or city tax) officials en route, with much red tape, delay, and annoyance, and necessitating a Government escort, which had to be paid for. It was actually more trouble and expense to move the dairy products from the Palace of Agriculture out to Vincennes Park, guard them there, and move back again, than it was to get them from New York to Paris; the products were also subjected to very much more exposure, deterioration, and injury. The location and conditions were as unsatisfactory to French exhibitors as to those from other countries. It was bad enough for local products, even although unaccustomed to refrigeration or any sufficient substitute for preservation; for products brought hundreds and even thousands of miles, the situation was well nigh disastrous. A vigorous official protest was made in

April on behalf of the United States dairy exhibit, but to no purpose. Unfortunately the circumstances were not appreciated by the United States commission, and the subject was not pressed upon the Exposition authorities as it should have been.

The latter made a grave mistake in thus locating and providing for the dairy shows. Aside from giving dissatisfaction to exhibitors, the attendance of visitors amounted to nothing, and as public exhibitions and object lessons they were failures. In this respect the temporary fruit and flower shows held in the fine horticultural buildings and the grand Salle des Fêtes, and constantly crowded with visitors, were an instructive contrast. And while the dairy displays were being so poorly provided for, the Salles des Fêtes stood empty and useless, as it was most of the time. This very large and magnificent hall occupied the center of the immense building known as the Palace of Agriculture. The hall was surrounded by the agricultural exhibits of all nations. On either side were food displays of France and those of other countries, all under the same roof and including the permanent dairy exhibits. This hall was the ideal location for the dairy shows and was well suited to the purpose. It was quite large enough, light and yet well shaded, with a floor which could be kept clean, and ample mechanical contrivances for ventilation and for cooling the atmosphere. Several artificial ice machines were in daily operation within a few rods. No good reason appears, or has been given, for the serious administrative blunder in not holding the dairy shows in the Salle des Fêtes. At this place they would have been convenient for all exhibitors, amid tasteful, attractive, suitable, and favorable surroundings, and would unquestionably have proved to be popular and instructive exhibitions.

All dairy products were entered in Group VII, agriculture, and in class 40, food products of animal origin. The international jury of award for this class was composed of nineteen Frenchmen, two members each from Great Britain (one for Canada) and Switzerland, and one each from Denmark, Germany, Holland, Portugal, Russia, and the United States. The jury organized by the election as president of a member of the senate of France and president of the National Society for Encouragement of the Dairy Industry; as vice-president, the member from the United States; as reporter, a French cheese manufacturer with extensive dairy connections in central and southern France; and as secretary, one of the largest and best-known cheese merchants of Paris. Among the members were officers of some of the principal milk-supply companies of Paris, the heads of the two largest butter factories in France, the director of the union of Roquefort cheese makers, representatives of the leading Paris houses for dairy products and of the Gruyère syndicates of the Jura region, the secretary of the National Dairy Association, the director (or principal) of the National Dairy School of France, three dairy officials of national governments (other than France), and two members of large milk-condensing establishments. As thus constituted and organized, the jury was already rather too large (29), but its members represented, collectively, a thorough knowledge of the dairy industry in all its branches, and broad experience in the products and markets of the world. It was a strong body, quite capable of performing well the duties devolving upon it. The service of this jury had hardly begun, however, when "the administration" added as "expert assistants" and "degustateurs," or tasters, twelve men from the active butter and cheese trade of Paris. With two or three exceptions, these were young fellows who knew the Paris markets, but nothing else. They were embarrassingly active in the judging, pressed their opinions, and in a good many cases very meritorious products, other than French, were marked down and the awards degraded, because of not meeting the narrow Parisian standards of taste. This needless and annoying addition made the jury too large for efficiency and materially weakened its work. Decisions are thus accounted for which were not in accordance with the actual merits of the articles exhibited and which would not have come from a smaller and more deliberative body of competent men.

The jury met almost daily during the last half of June and the first week in July, and examined with care, first in a body and then by committees of specialists, the permanent dairy exhibits of the various countries. The examination of the perishable products of the temporary shows began, respectively, on the 24th of May, the 26th of July, and the 20th of September, continuing several days in each case. An office room was set apart for the use of the jury in the Exposition Palace of Agriculture, and on several occasions meetings were held in a quieter and more comfortable apartment courteously provided at the ministry of agriculture, rue de Varenne. After the examinations and scoring by individual members and committees, the full jury met, received reports, discussed the questions arising, and decided upon the awards. All the proceedings were, of course, conducted in French, and the records and reports made in that language. Under instructions from the Exposition administration, every exhibit deemed worthy of any notice was assigned a mark upon a scale of 1 to 25 and reported upon solely by the mark; but it was understood that the marks carried awards upon the following basis:

1 to 5, inclusive, honorable mention.
6 to 10, diploma of bronze-medal grade.
11 to 15, diploma of silver medal.
16 to 20, diploma of gold medal.
21 to 25, diploma of the grand prize of honor.

Although the reports of committees and subsections upon individual exhibits were generally accepted by the full jury and the decisions confirmed, the awards of gold medals were frequently challenged and discussed. This was always the case with collective exhibits, and the award of a grand prize was made only upon a formal vote at a general meeting. At the closing sessions of the jury, in September, when the final decisions were made and the official report prepared, the president was absent and the vice-president from the United States was in the chair. All reports from the class juries were submitted for revision to a higher, or group, jury, composed of the officers of the class juries. The awards of the jury for class 40 were approved by the jury for Group VII, with two or three minor exceptions not affecting the United States, and recommended for confirmation. The group jury took special action in making up the list of collaborators, to whom awards were made individually in recognition of their personal services in connection with certain exhibits or the work of invention, progress, or improvement thereby represented. The awards were finally passed upon by a large and specially selected superior jury, including several members from the United States. The work of this jury was mainly *pro forma*—certainly so as to all awards in class 40.

The articles in the permanent exhibit were reported upon before the end of June and received no further attention from the jury. Regulations provided that French exhibitors at the temporary shows must exhibit at all three and their rating would be the average of their three scores or marks. But exhibitors of products from other countries were permitted to enter at one or more of the three shows, and awards were made in the foreign sections at each of these exhibitions. This was a just provision, and at the same time a generous one, on the part of the Exposition authorities. While no single French exhibitor could thus receive more than one award upon similar entries at the three shows, the same foreign exhibitor might receive three awards—possibly, for example, with one cheese or three cheeses from the same lot. But the United States exhibit at these temporary shows was managed so as to avoid repetitions, and so far as possible entries were from a different set of exhibitors at each show. The entries in the permanent exhibit afforded opportunity for a fourth set of exhibitors from this country.

Under these circumstances, there was no actual competition among exhibits or exhibitors. Every entry was inspected and marked upon its own merits, or was supposed to be, regardless of any other exhibit. It was a system of grading rather than competing. Thus, for example, in the display of any one country, several lots of butter might each receive a silver medal; although they might be marked 12, 15, 13, 11, and 14, no two alike, all would receive the same diploma, being placed in the silver-medal grade.

Great care was taken by officers of the Department of Agriculture to have different parts of the country represented and to exhibit only products of the highest quality. The assistance of State dairy associations was obtained in selecting farms and factories to be invited to exhibit. These invitations were generally extended to those who had been prize takers in large exhibitions in this country. Yet few offers of exhibits voluntarily made were declined, where the quality of the products was satisfactory. All butter and cheese intended for the Exposition were brought together periodically at a cold-storage warehouse in New York, there critically inspected, and only such material as reached a fixed standard of quality was forwarded to Paris. The standard was necessarily changed somewhat from month to month. Products found unsuited for export were sold in New York on account of the contributors. This culling process resulted in maintaining a high average quality in the United States dairy exhibit at Paris, and in securing some award for nearly every entry from this country. Products were included from 20 States, as widely separated as Maine, Georgia, Minnesota, and California, and from 105 different contributors. Butter was exhibited from the 4 States above named, as well as 12 others; cheese from California, Nebraska, Wisconsin, Michigan, Ohio, New York, and Vermont; condensed milk from Atlantic and Pacific States and others between, and fresh milk and cream from Illinois, New Jersey, and New York.

A full list of the awards to dairy products from the United States is appended. Including the collaborators and the collective awards, as for the State of New York and this Department, the total prizes won were as follows:

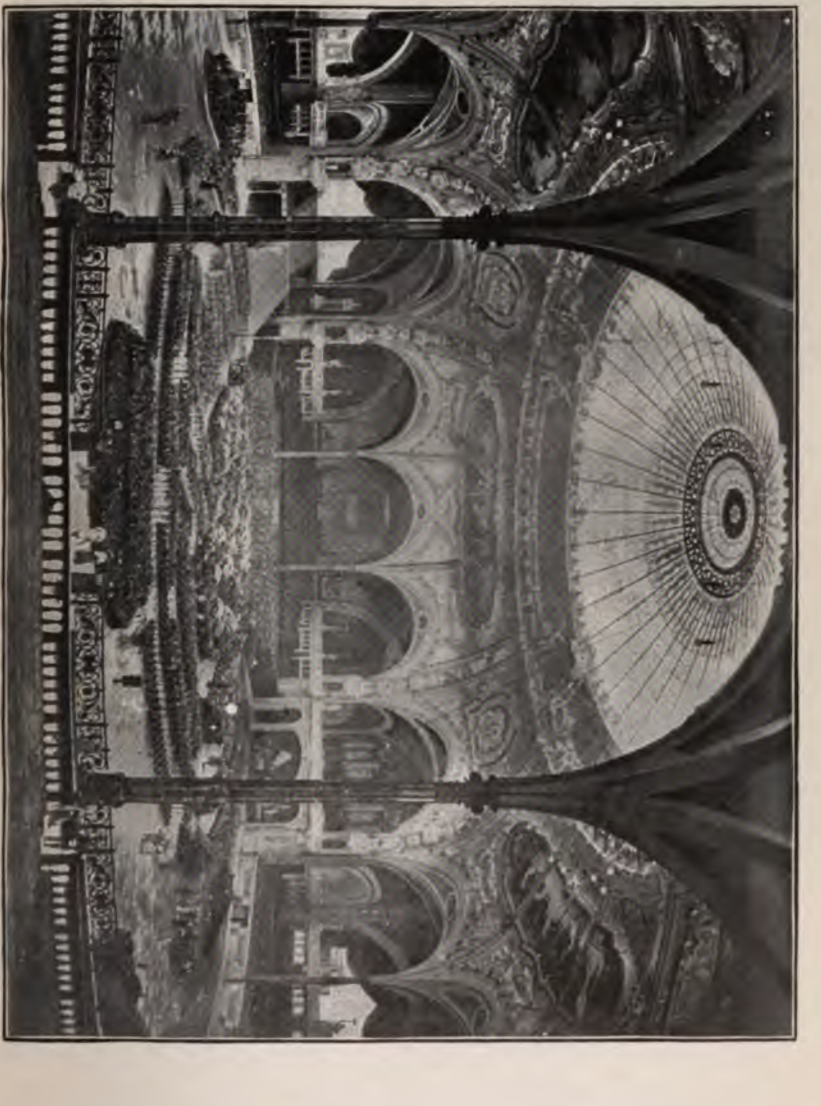
Grand prizes	6
Gold medals	38
Silver medals	52
Bronze medals	28
Grand total	124

No such result would have been possible but for the complete and efficient arrangements for transportation, care in Paris, and exhibition, made by the officers of this Department in conjunction with those of the United States Exposition Commission. Portable refrigerators were made in the form of chests, with capacity for 50 to 100 pounds of butter, and a water-tight ice box holding 40 or 50 pounds. In these the products were packed at stores of the Merchants' Refrigerating Company (New York), the ice boxes filled at the latest hour possible, and the chests quickly transferred to the cold room on the ship. Ocean refrigeration was secured through the courtesy of the Schwarzschild & Sulzberger Beef Company of New York, lessee of the cold compartments on the American line of steamships, New York to Southampton. Upon notification when a shipment was ready, this company left space in an export beef box to be occupied by the exhibit material. Upon landing at Southampton, England, the same company provided cold storage for the dairy chests at the docks until they could be placed securely upon the steamboat to Havre. No refrigerated transportation was available beyond Southampton, but the trip to Havre was always made in the night, the chests transferred at Havre in the early morning (more than a mile across the city) to shady sheds at the railroad, then loaded and moved to Paris by a fast-freight train in the night. Arriving at Southampton on Wednesday or Thursday, the products usually reached Paris on Saturday morning, the twelfth day after loading at New York. Special acknowledgment for courteous and efficient assistance all through the season, in this important matter of transportation, is due to the companies above named, as also to the officials of the London and Southampton Railway Company, which controlled the docks at Southampton and the boats to Havre, and to Messrs. Langstaff & Co., its agents at Havre, for expeditious forwarding.

The greatest difficulties were encountered at Paris, where railway terminal facilities were entirely inadequate, the customs officers slow and unsympathetic, and the Exposition regulations needlessly obstructive. Although the goods reached an express-freight station within the city, and little more than a mile from the United States agricultural exhibit, before daylight, it was often late in the afternoon before delivery was made at the latter place, even with the assistance of the transfer facilities of the American Express Company. Meanwhile the chests were unavoidably exposed to the sun and heat, and their refrigerator construction alone saved the contents. When opened on the exhibit space to transfer their contents to the display refrigerator, sometimes on the thirteenth day after packing, more or less of the New York ice was found unmelted in the boxes. These same refrigerator chests were used in transferring the products from the Champ de Mars to Vincennes, for the special shows. They were also kept under the benches in the Vincennes tent during the shows and a daily supply of ice obtained, so that those exhibits specially needing this protection were cold-stored every night during the temporary show, and sometimes cooled for an hour during the day, being thus kept in very presentable form, despite most unfavorable exhibit circumstances. The United States was the only country having any such facilities for carrying, storing, and protecting its products, and the dairy refrigerator chests elicited almost as much interest and commendation as the milk, butter, and cheese from this country, which they preserved in such excellent show condition.

Referring to the appended list of awards for dairy exhibits, in class 40, the following comments seem desirable. Two of the highest distinctions—the grand prix d'honneur—are especially notable.

The first was won by Samuel Haugdahl, of New Sweden, Minn., for a tub of butter at the special show in May. This was the only instance during the entire exposition in which the highest honor was awarded to an individual exhibitor for a dairy product. The same



Temporary Horticultural Show in the Salle des Fêtes, Paris, June, 1900.

award was made in several cases to collective displays, but to no other single exhibit or exhibitor. The United States and the successful maker may thus justly claim to have received what was virtually the grand sweepstakes, or very highest award, for a single lot of butter shown at the World's Fair of 1900. It may be added that this decision was made by the French members of the jury, while the American member was absent, serving upon the subjury on cheese, and without his solicitation; it was solely upon the merits of the article. Later, some members of the jury seemed to think this action too exceptional and revision was proposed, but the majority sustained the original award, which was duly confirmed.

The second grand prize was awarded to the Borden's Condensed Milk Company of New York for its display of the "Eagle," "Peerless," and other brands of condensed milk in the permanent exhibit. This was the only article of exhibit of this character which received the highest award. But it should be stated that two, if not three, similar exhibits were "hors concours" (not competing) because representatives of these companies were members of the jury. If this is any qualification of the award, it is also a compliment, for it shows that the company which has succeeded the originator of this product and the parent factory of the industry is recognized by its strongest foreign competitors as producing an article which commands their highest commendation. No award for condensed milk could have been higher, in any event, for the jury assigned the maximum mark of 25 to this exhibit, meaning virtually a declaration of perfection.

The other four grand prizes were awarded to the United States Department of Agriculture for the collective exhibits by the Dairy Division of the Bureau of Animal Industry—one for each of the special shows and one for the permanent exhibit. No other country except France received so many of these highest honors. At the July show the jury directed (in the absence of the writer) that the following be added to the official recommendation for the United States award of the grand prix: "With the felicitations of the jury upon the uniform excellence of the products and the admirable manner in which they are exhibited."

A part of the American exhibit, which was most creditable in itself and attracted much attention, was the small collection of natural milk and cream in commercial form. Three enterprising dairies engaged in city milk supply upon modern methods contributed milk and cream in small quantities every two or three weeks, so that this was an almost continuous feature of the United States exhibit. Regular delivery bottles—quarts, pints, and half pints—were used, the only extra precautions being to use two paper caps instead of one and to cover these with paraffin so as absolutely to exclude air. In a few instances, owing to undue exposure en route, the milk reached Paris in a slightly sour condition. But generally it not only arrived in good condition, but remained sweet for some days afterwards, being quite sound on the fifteenth, eighteenth, and sometimes the twentieth day after leaving the cow. Foreign visitors and expert milk dealers on the jury were hard to convince that nothing but "cleanliness and cold" were used to preserve these products. Full descriptions, with photographs and affidavits to explain the sanitary conditions under which this milk was produced and prepared, were supplemented by exhaustive examinations and tests by an eminent French chemist. When finally satisfied that they were honest exhibits, all three were promptly awarded gold medals. The Briarcliff Farm Dairy, of Westchester County, New York, the Fairfield Dairy, of Essex County, New Jersey, and the Clover Farm Dairy, of De Kalb County, Illinois, were thus justly honored. But numerous other dairies in this country conducted upon sanitary principles might have done quite as well, and fortunately the number of these sources of supply of natural pure milk is rapidly increasing. Exhibits were also made of American milk pasteurized and sterilized; but there was nothing remarkable about these, and they attracted little attention.

No other country except France attempted to show natural milk and cream. There were numerous exhibits of pasteurized and sterilized milk from Austria, Belgium, Germany, and Switzerland, as well as France, which were creditable enough in their way, but by no means deserving of the substantial recognition they received at the hands of the jury. The French exhibits of natural milk and cream were in striking contrast with those from the United States. At the July show there was not a single one of these local exhibits which was fit to use the day after reaching the grounds, and even in the moderate temperature of the May and September shows the French products were all sour on the second and third day. But there stood the natural products from America, just as they would be delivered to consumers in New York and Chicago, still perfectly sweet a fortnight after being bottled and after a summer journey of 3,000 or 4,000 miles.

The United States exhibit of condensed milk and "evaporated cream" was large and excellent in quality, comparing favorably with like products from other countries. There were nine exhibitors and a great variety of brands. The jury gave these goods a critical examination and, besides the grand prize already mentioned, awarded eight medals, two of gold and three each of silver and bronze.

During the season several lots of the very best butter of the United States were displayed at the Paris Exposition, and in nearly all cases they were placed on exhibit without being perceptibly impaired in quality, although, of course, they were two or three weeks old. Experienced and competent judges would unquestionably have pronounced these butters equal, on the average, to any in the world, and certainly to any shown at Paris. But they were not appreciated by the exposition jury and did not receive their deserts. With a single exception, they were salted butter, and that is probably enough to account for the result. All the best butter of Europe is without salt, and is sold and generally consumed within a few days from the time it is made. In the Paris markets no butter for table use is salted and the "expert tasters" on the jury knew only the Paris markets. In those markets the poor and faulty butter is salted and sold for cooking and confectionery. Any butter that was salted meant to these jurors an inferior article, full of faults which salt was to hide, and fit only for the baker or the second-rate cook. This experience and prejudice could not be overcome. The one unsalted exhibit was promptly given a gold medal and some of the lightly salted lots fared pretty well. Occasionally an exhibit had such conspicuous merits that recognition could not be denied, but as a rule, if the salt was distinctly perceptible to the taste, it required much urging, and the assurance of its standing at home to secure any award whatever for such butter. To illustrate, ten gold medals were awarded to United States butters; these were all light salted except one. These ten lots were carefully judged and scored before leaving New York, within a fortnight of the Paris judgment, and their average score was 95 points. Ten other lots, with more salt, were given at Paris, five silver medals and five of bronze; the average score of these ten in New York, a fortnight earlier, was 96.5 points; in the first lot only two scored above 95; in the second lot three scored 97 and two 98. It must be admitted, however, that the jury experts were educating themselves by their exposition work and improved as time passed. At the May show the United States received one gold medal on 12 butter exhibits; at the July show, two gold medals on 26 butter exhibits, and at the September show, six gold medals on 27 butter exhibits. This shows a decided gain. The American butter at the July show, and which won only two gold medals, was made in June and was, as a lot, decidedly superior to that shown in September, which was made in August, yet won six gold medals.

In all there were 56 exhibitors of butter from this country and they won 65 prizes, namely, 1 grand prix, 10 medals of gold, 32 of silver, and 22 of bronze.

The only country with which the American butter exhibit can be at all compared was that of France. Two hundred and thirty French exhibitors had butter at all three of the shows. Among these there were thirty-seven awards of gold medals, or 16 per cent of the total exhibits. The ten gold medals for the United States constituted 15½ per cent of its total exhibits, and, counting the one grand prize as an additional medal, gives 17 per cent, or a greater proportion of first-class awards for this country than for France. Thus the United States stands very well by this comparison. It must be admitted, however, that the French butter exhibit as a whole labored under two disadvantages. First, as already stated, every exhibitor was obliged to show butter three times and his award was upon his average merit; second, the French section was open to everyone who chose to make entries, and there was much poor butter shown, while the United States sent only selected lots.

As to the different sections of France, the region of Normandy led with 84 exhibits, 24 of which, or 27 per cent, won gold medals. This was nearly all from the district of Isigny, in the department of Calvados. Brittany and French Flanders came next; 20 exhibits and 5 gold medals, or 25 per cent. In this northern and northwestern region it is all farm-dairy butter. The creameries, mainly cooperative, are in the western part of the country, especially in the departments of Charente and Deux-Sèvres; from this district there were 72 exhibits, of which only 7 per cent won gold medals. It thus appears that, according to French judgment, the dairy butter of that country averages better than the creamery butter. But it was noted that the highest mark of all given to French butter was to the product of a cooperative creamery at Saint-Christophe-sur-Roc in Deux-Sèvres. All the rest of France together made only about 50 entries of butter, and these won four gold medals. There were in addition, however, awards of the grand prize to some of the largest and finest collections of French butter exhibited—the Agricultural Society of Bayeux, the Syndicate of Dairy Farmers of Isigny (those both in Calvados), and the Central Association of Cooperative Creameries of Charente and Poitou.

Very nearly all of the French butter was exhibited in what are called "mottes," being the usual form in which it is sent to market. These are lumps wrapped in white cloth, cotton or linen, and placed in cheap baskets usually without covers and of the shape of a peach basket or ordinary flower pot. In warm weather the lumps of butter are smaller than the baskets and surrounded and covered by a half inch or more of long wheat straw. For exhibit the mottes are emptied from the baskets and placed on the show benches with the small ends up. The cloth is then turned back to expose the butter for examination and tasting. In a few cases boxes of different sizes and shapes were used instead of baskets, but if the butter was in mass and wrapped in cloth it was still called a "motte." The mottes varied in size from 8 to 20 pounds. There were only 10 exhibits of French butter by the makers in the form of prints or blocks, and but two lots of salted butter in this entire section. But several Paris retail merchants exhibited butter in prints and rolls of a quarter pound and upward, very neatly wrapped and labeled, and also a variety of convenient small packages. Among the latter the local favorites were earthen bowls or crocks with covers holding 1 or 2 pounds and little square white baskets in which lumps of like size were nicely packed. The French market unit for butter is the *kilo*, which is 2⅕ pounds, but the "livre," or (large) pound, is still more or less in use in Paris, and the popular measure all through the country districts.

It can be readily understood that butter exhibited in such form, the lumps irregular in shape and size and wrapped in different ways and different cloths, presents anything but an attractive appearance. This butter has never been cold or hard, and although when exposed it "stands up" better than if it had been refrigerated, high temperature affects it in time. In hot weather the lumps become soft and misshapen, the cloths oily, and under the Vincennes conditions, without protective covering for days, all becomes dusty. Thus these entire exhibits of butter at the temporary shows soon had an unfinished, unsightly, neglected aspect—a very bad show form. But it was the custom of the country and all seemed satisfied. Very little artificial coloring is used in France; none during the pasture season, and the dairy cows of the country are not strong in the color attribute. A very light yellow was therefore the prevailing shade in these exhibits. Freshly made from cream, either sweet or very slightly acid, the flavor was negative, mild, flat, insipid. But that is what the Paris butter market likes—no distinct flavor. Now and then a butter was found in which a higher degree of cream acidity had been developed, resulting in a more attractive (?) flavor, but these lots were not often prize winners. Good grain is often sadly lacking in this French butter; some of it is waxy, but much is salvy and decidedly overworked. Yet it has a very fine texture, is free from buttermilk, and keeps well. Mottles are almost unknown—it is butter without salt. Although carrying a full allowance of water, this is so thoroughly and evenly incorporated that the butter appears to be very dry.

France is said to possess 6,500,000 cows, besides 10,000,000 sheep and goats which also contribute largely to the country's supply of dairy products; and 2,200,000,000 gallons is the reported annual milk product. Assuming that the product of the smaller animals only makes up for the cows not really dairy stock, the yearly average product of milk per cow is just about 400 gallons, or 3,470 pounds. The annual production of butter in France is believed to be 400,000,000 pounds. The regions of greatest production are well indicated by the entries of the Exposition. By far the largest part of the butter in this country is made on farms, in the households of the cow owners; and the primitive system of churning the whole milk while it is quite sweet is still much in vogue, particularly in Brittany. Creameries have been introduced within twenty years. The first cooperative establishment was that of Chaillé (Surgères), organized in 1888, with 88 patrons (or "sociétaires"), and producing that year about 65,000 pounds of butter. There were 100 cooperative creameries in this same region in 1900, with 50,000 patrons, owning 120,000 cows, and producing over 16,000,000 pounds of butter. In addition, there are nearly as many more creameries, most of them proprietary, about half in the west of France and the rest scattered through other parts of the country. The Association of the Creameries of Charente and Poitou, already mentioned as receiving a grand prize, operated the working creamery in the permanent exhibition at Champ de Mars during the Exposition. Butter was made daily, and the most improved creamery fittings and appliances of French manufacture were thus shown in practical use. The process of butter making pursued there did not differ materially from that ordinarily in vogue in America, but it was noted that it required rather more than twice as much labor (attendants) as would be used in this country to accomplish the same results. France imports from 10,000,000 to 15,000,000 pounds of butter annually, and exports from 50,000,000 to 70,000,000 pounds. England is the largest buyer, but large quantities are sent to the West Indies and South America; Brazil takes, 4,000,000 pounds a year, and this, of course, is salted and in sealed packages.

The other countries which made exhibits of butter worthy of comment were Denmark, Russia, Belgium, Luxembourg, Holland, Germany, and Switzerland. Most of these were at the September show. The Swiss entries of butter were very disappointing. There were 16 lots, most of them in mottes and baskets, neater in finish and general appearance than the French but inferior in quality. Some were in prints and a few lots were salted. Only one gold medal was awarded, and that went to the instructor and butter maker at the Federal Dairy School at Rutti-Zollikoffen. Four received silver medals. In general, this butter was poorly made and definitely unpleasant in flavor. There was one lot of "process" butter, claimed to be "sterilized" and well adapted to export, but it was a very poor article.

The German butter was worse than that from Switzerland; this was shown in the permanent exhibit and examined by the jury in June. Although the conditions were most unfavorable at the Palace of Agriculture, where no refrigeration was attempted, the samples of butter in this exhibit were so very bad as to be entitled to no prizes whatever. Nevertheless several high awards were made, which were actually so many gratuities.

Holland sent butter to the May and September shows. There were 10 entries and in a variety of forms—small kiels, or kegs, holding 10 to 20 pounds, blued tin cans of 5 to 10 pounds, white wood oblong boxes with sliding covers, holding about 10 pounds of butter packed solid, and similar boxes containing the butter in pound bars, each in a wrapper or paper case, ten or twelve of these to a box; also sealed cans of several sizes for export. But none of this butter was good. No gold medals were awarded, and five lots barely got into the silver grade by generous treatment. Considering the perfection to which cheese making has been carried in Holland and the high quality of the cheese shown by that country, it is remarkable that the butter is no better, especially so since the most prominent exhibits were made under the auspices of the Dairy Society of Frise, a province in the north of Holland, where the Danish methods have been adopted. The first cooperative creamery was established at the village of Warga in the year 1886, and there are now 45 such establishments in the province. Some of these are quite large, and they collectively receive 400,000,000 pounds of milk a year. They are organized in a strong association to advance their common interests, and have adopted the trade-mark *Nedraw* for their products. The headquarters are at Leeuwarden. The factories make cheese at times, as well as butter, and it is probable that this largely accounts for the poor quality of the latter product, as shown at Paris.

Belgium made quite an extensive display of butter at the September show, there being over 50 entries. It was generally in the form of bricks and prints, from one-fourth to 1 pound weights, packed in boxes holding 3, 5, 8, and 10 pounds. The prints were neatly wrapped in parchment paper, and were often in cartons or paper boxes. The average quality of this butter was good, without being superior. But this is a source of supply very convenient to French markets and presents an active rival to French butter. As a consequence, it is looked upon with little favor in France, and a jury, in which the Paris element was paramount, criticised the Belgian butter very closely and showed no generosity in making awards to this country. Four gold medals were given, and a dozen of silver.

The Grand Duchy of Luxembourg made a single collective exhibit representing the general syndicate of cooperative creameries in that country. This butter appeared at the May and September shows, in 1-pound bricks and 10-pound boxes—well made and a good article—and was accompanied by an interesting description, with map and illustrations, showing how the dairying of the country had been recently revolutionized. Under Government supervision the farm dairying has been replaced within seven years by a well-distributed system of cooperative creameries. These now number 66, with 3,143 patrons, and jointly produce several hundred tons a year. This is fresh butter, made from sweet centrifugal cream, and can be easily delivered in Paris in perfect condition the day after it is made. This is not pleasing to French dairymen, and there was no disposition evinced to encourage or commend this admirable piece of dairy progress. The collective exhibit was as well worthy of the highest honor as others which received it, but this received only a silver medal at first, which was later reluctantly raised to gold.

At the May exhibit the entries from Russia were unexpectedly large and fine. The butter was shown in casks or firkins made of birch or a similar wood and containing about 100 pounds each. Of these there were 40, from as many different creameries, besides some smaller packages and butter in sealed cans. Nearly all of this butter was salted and evidently colored, some too much, but it was otherwise very uniform and of high quality, although not the best. It was, however, quite a revelation that various parts of Russia are producing such good butter and in such quantity. As very little of it is consumed at home, the new supply is appearing in the large markets of the world and offered at prices so low as to give concern to producers in other countries. The creameries represented by this interesting display, which very justly received a number of good awards and the grand prize collectively, are many of them cooperative and are located in different portions of Russia and Siberia. All have been established within thirty years and most of them during the last ten or fifteen years. One in Wologda, begun in 1871, receives 1,400,000 pounds of milk and produces 60,000 pounds of butter annually; another in Novgorod, 1884, 4,000,000 pounds milk and over 160,000 pounds butter; and another in Tobolsk, Siberia, 1897, 3,500,000 pounds milk and 135,000 pounds butter. These are average examples; there is one ten years old in Wologda twice as large as the second above. In the year 1871 the first dairy school in Russia was founded by the government of Twor, and two others soon followed by the governments of Riasau and Toula. At this time melted butter only was exported from Russia, and Turkey was almost the only market. Very rapid progress has been made since in the organization of creameries, the diffusion of dairy instruction, the quantity of butter produced, and improvement in its average quality. The work is supervised and assisted by the central government. Western Siberia has been the region latest developed and in which progress has been most rapid. There are now in that region 334 creameries, and in European Russia about 1,000; many of these are new and very small. The product of these establishments differs greatly in quality, but as the result of government inspections of the export butter it is reported that 15 per cent is rated excellent, 40 per cent satisfactory, and the remainder of mediocre quality or lower. The annual export of butter from Russia is now about 25,000,000 pounds. Rather more than one-fourth of this goes to Germany, a little less to England, about one-sixth to Finland, and the rest (or most of it) to Turkey and Austria. The portion to Finland is really in transit, being exported again, mainly to Denmark. The London market alone takes 5,000,000 pounds of Russian butter a year, imported either directly or by way of Denmark. Having made a decided "hit" at the May exhibit, Russia did not appear again.

On the other hand, Denmark, which was expected to be an important contributor all through the season, did not appear in the entries of butter until September. Then a most excellent display was made,

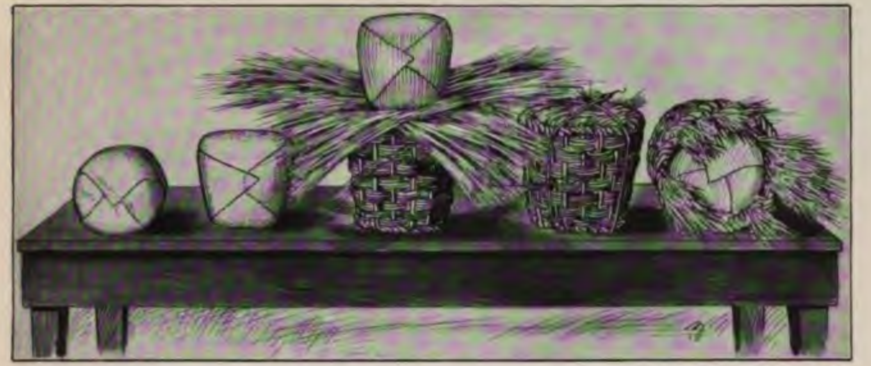


FIG. 1.—THE FRENCH "MOTTE" OF BUTTER, WITH BASKET.

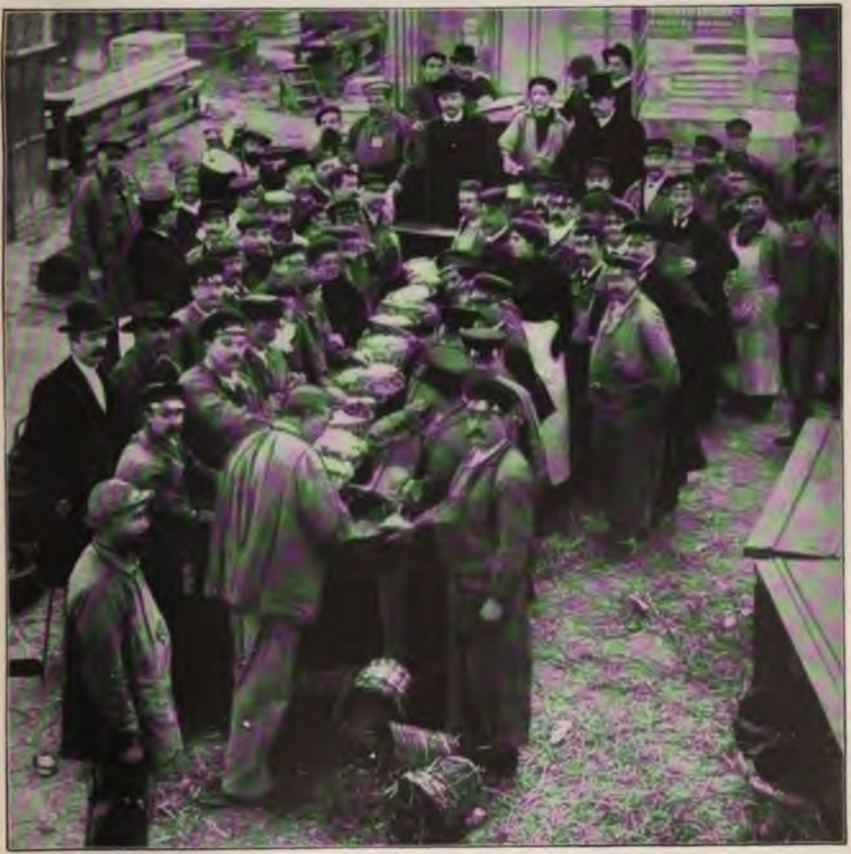


FIG. 2.—AUCTION SALE OF BUTTER (IN MOTTES) AT PARIS MARKET.

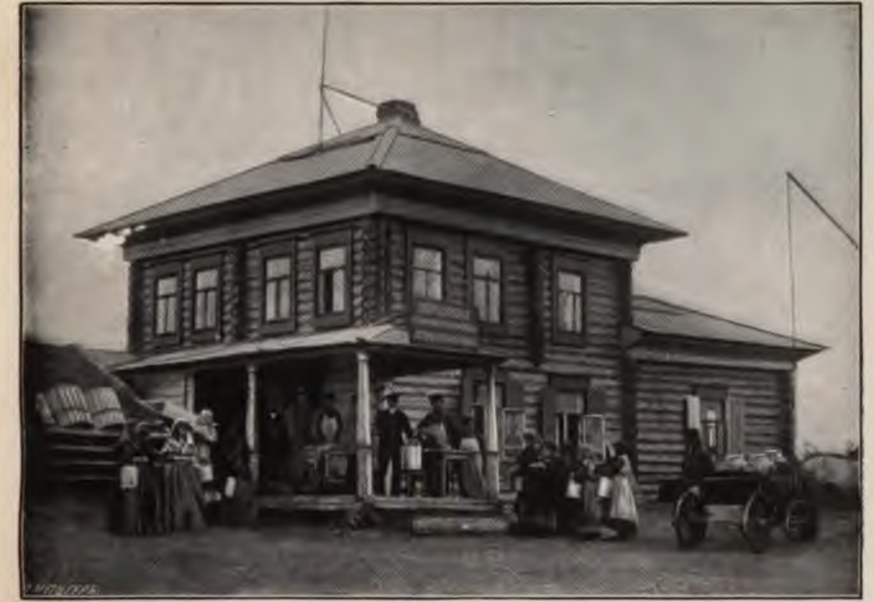


FIG. 1.—A RUSSIAN COOPERATIVE CREAMERY IN SIBERIA.

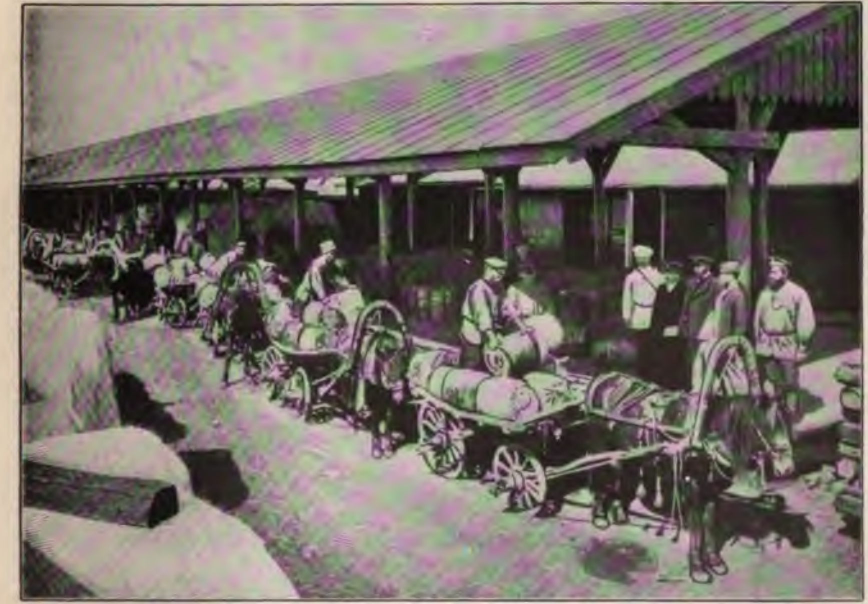


FIG. 2.—SHIPPING RUSSIAN BUTTER TO LONDON FROM SIBERIA.

not large, but admirably shown and of high average quality. There were three collective exhibits. The first was from the Association of Cooperative Creameries for the Export of Danish Butter, headquarters at Esbjerg. This consisted of 10 baskets of 20 pounds each, and 10 boxes, each containing two dozen 1-pound blocks. The baskets or mottes were of unsalted butter, suited to the Paris market; the packages were neater than those common in France, with covers and good linings. The boxes were prepared for the London trade, the butter half salted, and each pound in a separate labeled wrapper. The second lot was from another association of cooperative creameries of Denmark, with headquarters at Kolding; 10 baskets or mottes of the 10-pound size, and 20 little kiels or kegs, each holding 20 pounds. This butter was salted and half salted, of the remarkable uniformity for which the best Danish export butter is famous, and of a quality unexcelled in the entire exhibit. The third entry was made by Carl Holbeck, of Copenhagen, a merchant who does an exporting business of over $2,000,000 a year, and consisted of samples of his supplies from different makers. There were a dozen mottes of Irish butter of 20 pounds each, shown in French style, wrapped in cloth; London boxes, with 1-pound and 2-pound rolls or blocks, lightly salted, and salt butter in sealed tins for distant markets. All of this Danish butter had been made within ten days of the time it was judged, and the display was under the supervision of Bernard Böggild, late secretary of the Royal Agricultural Society of Denmark, and now dairy expert and adviser for that body. The butter was submitted to the jury as three collections; the first and third lots were awarded gold medals, and the second the grand prize. The Danish commission also received the highest honor for the exhibit as a whole. Denmark is noted for the rapid development of its dairying during recent years and for the present extent and prosperous condition of that industry. The first cooperative creamery in that country was established in 1882, and the immense export trade in butter, almost all of it creamery product, has been built up since that time. Much had been done, however, to improve dairying during the decade preceding 1882. The number of milch cows in 1871 was 807,000; in 1881 there were 850,000; and now there are about 1,100,000. The export of butter, which was 30,000,000 pounds in 1871 and only 53,000,000 pounds in 1887, has now become 170,000,000 pounds. There are 1,200 cooperative creameries and 300 operated on the proprietary plan. The quality of the butter product has been equally advanced. The Danish Government takes an active part in the work and closely watches the exports to see that the butter sent abroad is absolutely pure and of a standard which will enhance the reputation of this commodity. The result is that Danish butter stands at the very head of the markets in Great Britain, and the latter country takes over 95 per cent of all exported by the former. The butter of Denmark in sealed cans also holds the highest reputation in all the remote and nonproducing markets of the world.

The exhibitors of cheese from the United States fared much better at the Paris Exposition than those who sent butter. In all, 38 entries were made for 34 different exhibitors, and 38 medals were won. These were 19 gold, 16 silver, and 3 bronze. Thus every exhibit received an award, and as the three bronze medals were assigned to persons who also received something higher at another time, every American exhibitor of cheese received a medal of either gold or silver, and 50 per cent of these exhibits won gold medals. The largest and best display of cheese was at the July show; despite the torrid conditions and some "huffing" of the cheese, which could not be avoided, 17 entries were awarded 12 gold medals and 5 of silver. This is a very satisfactory record all through.

It is not difficult to account for the cheese exhibit of this country being more successful than the butter. The article was better understood by the examining jury. Cheese of the general American factory or Cheddar type, although little sold in Paris, is by no means unknown in French markets. The experienced merchants and makers of pressed cheese who were members of the jury and whose opinions decided these awards were fully familiar with the American commodity. It is only just to record that the member for Canada was a potent factor in securing these results. Very consequential was the fact that there were no other exhibits of cheese, and especially none of French origin, of the same general class and with which these from the States could be unfavorably compared by any peculiar fancy of French taste. The writer feels bound to add his individual opinion that, while all this American cheese was excellent of its kind and well deserved the awards made, the average quality of the butter shown from the United States, and its condition when exhibited, was equally good, perhaps even more closely culled, and upon its actual merits, as well as comparatively, its harvest of awards should have been as rich as that obtained for the cheese.

There were no foreign exhibits of cheese with which those from this country could be well compared as to either quality or prizes won. There were admirable displays of Canadian cheese in the permanent exhibit and also at the September show. At the latter the "yearlings" shown, both white and colored, could not be excelled. But the Canadian commission preferred to have these exhibits judged collectively; consequently the cheeses were not scored singly, but only a few samples examined, and the collection awarded the grand prix, the same as the collective exhibit by the United States. The British Dairy Farmers' Association entered a case of cheese in the permanent exhibit which contained one to three samples each of Cheddar, Cheshire, Leicester, and Stilton. This collection was awarded a gold medal, being on a par with the New York State collection in the same exhibit.

The other foreign cheese exhibits, mentioned in the order of their importance and merit, were those of Switzerland, France, Holland, Russia, Italy, Germany, Portugal, Greece, Hungary, Bulgaria, and Mexico. The half dozen entries from Mexico were none of them very good, but three were interesting and deemed worthy of silver medals. The government of the State of Zacatecas sent large loaf-shaped cheese, 2 or 3 years old, quite hard and something like the Parmesan, but richer, with a clean flavor, but sharp. From the territory of Lower California there were peculiar little cheeses—thin, flat, and white, like a soda cracker, and said to be a great local favorite; from the State of Mexico, a brick-shaped article, about 9 by 12 inches and 4 inches thick, the rind yellow, with red streaks and the interior of cream color, hard, and full of small eyes or shot holes. All three of these exhibits were given silver medals. Bulgaria exhibited a cheese called Kaehkaval, in size and style like an English dairy, but quite white and made of sheep's milk. The exhibitor is said to be the maker of over 100,000 of these per year, which are largely sent to Constantinople and there sold at about 30 cents a pound. From Varbovo (Widdin), in the same country, was shown a moist, soft curd, snow white, made from the whole milk of sheep, not pressed, and preserved in brine; this was a year old and quite good. At its home this is an important food product and sells at the very low rate of 3 cents a pound. A gold medal and one of silver rewarded these two exhibits. Hungary made what was decidedly the most artistic and attractive display in the entire agricultural section; two entries of cheese received the same awards as those to Bulgaria. The first was a soft kind, like Camembert, small, round, well made, packed in tin foil, and strong enough to satisfy the most highly educated taste; this was the usual product of a herd of 200 cows. The other was from sheeps' milk, white, granular, and packed in little wooden firkins holding from 2 to 4 pounds; it has a taste and odor all its own. The sole dairy exhibit by Greece was a cheese made from the milk of goats, at a school of agriculture—Aidini (or Halmyros), in Thessaly. It was similar in size and form to a large Gouda, although in character more like an English dairy, was 10 months old, an excellent article, very creditable to the maker, and deserving the gold medal awarded. Portugal made a large number of entries in the catalogue, but only eight lots of cheese were actually shown. Most of these were of the Parmesan character, but nearly all small—from 1 to 4 pounds in weight. There were a few from the milk of sheep and goats, some soft, like the Brie, and others very small, white, dry, and hard. These eight lots all got medals of different grades, two being of gold and hardly merited. Italy made over thirty entries of cheese and had thirteen lots on exhibition. Parmesan was naturally the leading variety;

these cheeses were 2, 3, and 4 years old, coated with linseed oil and animal charcoal, and rubbed till they shone like polished ebony; they were round and flat, 4 or 5 inches thick, and large enough to weigh from 50 to 80 pounds. They came from Parma, Milan, and Reggio-Emilia. Five lots were shown in exceptionally good order, with fine flavor, and each was awarded a gold medal. Other kinds were made from sheeps' milk, some spherical, but roughly formed, white, and dry; some in skins, of bottle or tenpin shape, also very white, but part of them covered with tin foil. These were the variety called Caciocavallo; they were a year old and well kept, but strong in taste. A large collection sent by the Chamber of Commerce of Naples received a gold medal, which seemed a needlessly high prize. Another lot from Sardinia, decidedly better, 4 years old, well made and well kept, received only silver; the latter were flat, 8 or 10 inches in diameter and 2 or 3 inches thick, also from sheep's milk. An exhibit similar to the last, but not nearly so good, came from the sheep of the Roman Campagna; the broze medal awarded was quite enough. Curiously, no Gorgonzola was shown in the Italian section. The cheese shown by Germany was nearly all in the permanent exhibit and most of it was in sealed tins. It was mainly of the Limburger, Backstein, and Munster varieties, with others of the same general, loud-smelling type, and there were also some like the French Brie and Camembert. The German member of the jury made his only appearance at the June meeting, when this display was visited. In spite of the serious defects in quality of the products examined, he so impressed a majority of the jury by eloquent descriptions of the estates and dairies they represented, their standing and importance at home, etc., that, despite the protests of a minority, these inferior lots of cheese were awarded half a dozen gold medals and more of silver, where bronze would have been good enough for any of them. The Russian exhibit at the May show contained over 100 cheeses, but none of a local or national character. They all represented the recent dairy development of the country, and were made in imitation of foreign products—Cheddar, Cheshire, Emmenthal, Gruyère, Edam, Limburger, Backstein, and Sapsago. The imitations were clever and some of the cheese very good. As a whole, it was a creditable show for a comparatively new dairy region, but the average quality was not high and the awards were generous. A few of the 43 factories represented in this exhibit were established prior to 1870, but most of them are only 10 to 15 years old. They are located in various parts of Russia and a number of them are cooperative. A few statistics will illustrate this branch of Russian dairying: A factory at Tiflis, founded in 1863, uses 1,000,000 pounds of milk annually and makes 50,000 pounds of cheese, besides butter; another in Caucasus, cooperative factory, 1863, about 1,800,000 pounds milk and

100,000 pounds Emmenthal cheese; factory in Smolensk, 1875, 4,500,000 pounds milk and 350,000 pounds cheese; factory in Yaroslav, 1877, 600,000 pounds milk, 60,000 pounds Edam cheese; factory in Kaluga, 1877, 250.000 pounds milk, 20,000 pounds Cheddar and 5,000 pounds Limburger and Backstein; factory in Vologda, 1886, 300,000 pounds milk, 13,000 pounds "fromage vert" (Sapsago) and an equal quantity of butter. The cheese exhibit from Holland was confined to the noted hard-pressed varieties of that country, Edam and Gouda, and the products were of high average quality. Besides a fair permanent exhibit, this country had a very good display at the May show, and in September one of the best of all. The Edams, some a year old, were admirably made, of dense body, excellent consistency, and finely developed flavor. All were spherical in form, nearly the same size, and weighed about 3½ pounds. A few were shown uncolored and a few bright yellow, but the characteristic crimson exterior prevailed, and some were covered with tin foil, while others were in spherical tin cases, sealed for export to hot climates. The Goudas varied greatly in size, from 1 pound to 20, but all were of regulation form, flat, with edges rounded in a half circle, and the thickness from a third to a fourth of the diameter. They may be called a plain cheese, with a mild, pleasant flavor, and in both body and taste somewhere between the Cheddar and Edam. They are very generally colored a bright chrome yellow on the outside. At the September show every one of the ten entries of Holland cheese received either a silver or gold medal, most of them the latter, and there were two grand prizes awarded, one for a fine collection by one of the largest of the Dutch exporting houses and one for the entire Holland exhibit, which included butter.

Switzerland, which had not previously been conspicuous at the dairy shows, made an exhibition of cheese in September which was one of the most notable of the season. It was so large that a special pavilion had to be constructed for it by the side of the dairy building at Vincennes Park. The cheese was entered in four sections: First, the Emmenthal variety, 109 entries; second, the Gruyère, 26 entries; third, the Sbrinz, 9 entries; and fourth, 13 entries of other varieties, including the Tilsit, imitations of the French Brie, Camembert, and Roquefort, the Sapsago or Schabzieger, and a few not so well known, named Baumont, Romadour, and Tomme. In all cases there were at least two cheeses to an entry, so that the display included considerably over 300 specimens. The main feature was the collection of more than 200 of the great "cart-wheel" style of Emmenthal cheese, generally known in America under the name of Gruyère or Schweitzer-käse. These are round, flat cheeses, from 3 to 5 feet in diameter, and 5 to 8 inches thick, weighing from 150 to 250 and sometimes 300 pounds. They are finely made, with a workmanlike finish, the body yellowish white, elastic, and dense, fine-grained, but with "eyes," or spherical holes, distributed throughout the cheese. In the best-made specimens these eyes are uniform in size, three-eighths to one-half inch in diameter, and very evenly distributed, showing a skillful control of the fermentation or gas formation. When cut the meat of the cheese has a dull, smooth appearance, but the concave surfaces of the eyes are bright and shiny. The flavor is distinct and characteristic, mild at first, but developing in strength with the age and treatment of the cheese. Each specimen was exhibited on a smooth board of its own size, which greatly assisted the attendants in dexterously turning these great cheeses over every day. Ten different Swiss cantons exhibited this variety. Berne seems to be the center of this industry; it had 63 entries and every one of them was from a cooperative factory. These cheeses were all selected from the commercial stocks of the factories, and were not bored or tested until submitted to the jury. The high average quality can be judged from the award of 41 gold medals and about as many of silver among 109 exhibitors. The Gruyère variety was shown by four cantons, all being made in single dairies, or farm-dairy cheese. This cheese is of the same type as the Emmenthal, and except for being smaller in size with a rather different finish, the novice could not distinguish between the two. But the Gruyère is far less uniform in quality and is considered inferior, as shown by the fact that none of these exhibits received a gold medal and only five of them silver medals. The Sbrinz cheese, also called Spalenkäse, is simply a Swiss Parmesan. They were equal in quality to the Italian originals and of even better finish. Several exhibitors showed cheese of all ages from 6 months to 5 years. One medal of gold and 8 of silver were awarded to the 9 exhibitors. Collectively, this was a most creditable section of the Swiss exhibit; nearly all the entries were from the canton of Unterwald. The rest of the Swiss cheese display was not remarkable, although the Sarrazin variety was of interest. This was made of cows' milk, but in appearance was a true Roquefort. It has not the exact flavor, yet was quite good. But the French jury looked upon it as a counterfeit and gave it no credit. The same maker, from Sarraz, near Lausanne, exhibited two cheeses of the same shape and size called Tomme, made from skim milk and sold at 8 and 10 cents a pound; one had the characteristic Roquefort mold, and the other none. The entire cheese exhibit of Switzerland was given a grand prize and the honor was well merited.

Cheese making is the most important branch of Swiss dairying and an important item in the commerce of the country. From 1850 to 1860, the average annual export of cheese from Switzerland was 12,000,000 pounds; this trade reached a maximum of 60,000,000 pounds in 1886 and 1887, and was over 50,000,000 pounds in 1899, worth about $8,000,000.

The principal importing countries, and something of the variation of the trade, are shown in the following table:

Exports of cheese from Switzerland.

Country of import.	Maximum.		Minimum.	
	Pounds.	Year.	Pounds.	Year.
France[1]	20,000,000	1886	11,000,000	1893
Italy	18,000,000	1887	6,000,000	1899
Germany	13,000,000	1899	9,000,000	1895
United States	7,200,000	1899	3,300,000	1888

[1] France, in 1899, 15,000,000 pounds.

It thus appears that the exports to France and Italy are declining, while those to Germany and the United States are steadily increasing. Nearly all the cheese constituting this trade was of the Emmenthaler kind.

France herself had a display of cheese less imposing than that of Switzerland and with fewer exhibitors, but it included a much greater variety. The entries numbered about 150 and the exhibits were good at all the shows. Besides individual entries by the makers, and a few collective exhibits by some group of local dairies and factories, there were several elaborate and quite artistic displays by leading cheese merchants of Paris. The latter showed remarkable variety in form and character, including numerous kinds peculiar to France and which never enter into general commerce. The cheese of this country may be naturally divided into two great classes—the pressed kinds, with hard rinds, and those not pressed, and soft. The former embrace the Gruyère, Cantal, Roquefort, and Port Salut. The manufacture of the first-named variety is confined to the eastern part of France, the Jura mountain region adjoining the Swiss frontier. It has been a leading industry for centuries in the section known as the Franche-Comté, but especially in the departments of Jura, Doubs, and Upper Savoy. The production of Gruyère in this region amounts to 44,000,000 pounds a year. This type of cheese is very old, and it bore the name "Vachelin," until the beginning of the nineteenth century; then importations to France began from the neighboring cantons of Switzerland, under the name Gruyère, which was soon adopted by the French. (The present Gruyère is probably a slight improvement upon the original Vachelin, but with no material change in form, size, and character; the Emmenthal is a newer form, developed from the Gruyère, larger, more open in body, and with some modification of manufacture.) One notable feature of the cheesemaking of the French Jura region is that it has long been carried on under a system of local societies, known as *fruitières*, which are founded upon cooperation among the milk producers. These associations have authentic historical record from the thirteenth century, and although it was much later before common factories were built for their work, the district of Franche-Comté can probably justly claim the oldest continuous system of cooperative cheese-making in the world. The cows of this country have been for centuries the red-and-white race known by the name of Montbéliarde, a regional type if not a breed. A syndicate of these factories and *fruitières*, numbering 600 subscribers, under the lead of the Agricultural Society of the Department of Doubs, with headquarters at Besançon, maintained a working factory in the French section of the permanent exposition, where one Gruyère cheese was made daily, as an illustration of the modern processes. This exhibit received a grand prize, as did also the collection of cheese at the temporary shows, made under the same auspices. The Cantal is the next largest cheese in France, and is the production of the mountainous districts of the department by this name, of Auvergne and others, in the center of the country. This cheese is usually made in the shape of a barrel and often 2 feet high and 18 inches in greatest diameter. It is well pressed but the curd is not cooked, and the body, while quite dense, is soft and very white. The exterior is dressed so as to have a white, chalky look. The cheese is not of high quality, but it sells at a low price, comparatively, and is fairly popular. The samples exhibited received moderate awards. Roquefort cheese is perhaps more widely known than any other, although not entering general commerce in as large quantity as the Gruyère. It is of very ancient origin, having been carried from France to the markets of Rome in the first centuries of the Christian era; its manufacture in the eleventh century, substantially as to-day, is well authenticated and the historical record is complete to the present time. The center of this industry has been the same from the first, the little village of Roquefort, situated upon the precipitous face of limestone cliffs 2,000 feet above the river Soulzon in what is now the Department of Aveyron, in the central part of southern France. This cheese is made from the milk of sheep, mainly the Larzac breed, which are grazed by the tens of thousands upon the hills and mountains in Aveyron and adjoining departments, and valued mainly as dairy animals. Although the curd is separated from the whey and put into the usual form by slight pressing in molds, on the peasant farms and at factories throughout this region, the cheese is nearly all taken to Roquefort for salting, trimming, and curing. The curing is accomplished in the famous natural caves in the mountain behind the village, and the large vaults lately built in connection with and supplementary to these caverns. The cool air currents, even temperature, and peculiar atmosphere of these caves cause the slow ripening and the development of greenish blue mold, which gives this cheese its characteristic appearance and flavor. The cheeses are round, about 8 inches in diameter and 4 inches thick, the average weight being 4½ pounds. When cured, the body of the cheese is quite soft and an ivory white, except as it is "marbled" by the growth of mold. The finishing and marketing of the Roquefort product is now mainly in the hands of two large companies, having abundant capital, the total output being over 3,000,000 cheeses annually, or about 6,000 tons. While Paris is naturally the chief market, cheese is shipped directly from Roquefort to all parts of the world. The two principal *Sociétées des Caves* or manufacturing companies made elaborate and attractive displays at the Exposition, not only of their products but of large models and pictures of the Roquefort cliffs and caverns, cheese-making appliances, etc., and each was awarded the grand prize. The Port Salut is the only other pressed cheese which appeared in the French exhibit. This originated about thirty years ago at the abbey of the same name, in the Department of Mayenne. It has been copied elsewhere and is now made in numerous places, especially at the industrial establishments of religious orders. One of the popular forms takes the name of La Trappe, from its place of manufacture in Calvados. These cheeses are of cooked curd, quickly made, hard pressed, in various sizes, but the usual shape is that of a flat thin Gouda. Ten inches in diameter and 3 inches thick was noted as one size, and another 6 by 2 inches. The odor and flavor are both peculiar and not pleasant on first acquaintance. The silver medals awarded indicated that this class of cheese has its friends in France. A cheese similar to the Edam is made in the west of France, and another firm, pressed cheese in the Pyrenees Mountains, but neither of these appeared at the Exposition.

The soft, unpressed cheeses of France, called "*fromages à pâte molle*" and "*fromages affinés*," are given many different names, but they have a general resemblance and vary only in minor points—shape, style, and the age of ripeness (or decomposition) to which they are carried. The oldest and best known varieties are the Brie, Camembert, and Coulommiers. The first was known at the beginning of the fifteenth century, the second is something more than 100 years old, and the third is of more recent origin. Other popular kinds are Pont l'Évèque, Géromé, Livarot, Langres, Maroilles, and Mont d'Or. All of these soft cheeses are shaped in molds of different sizes and shapes and afterwards cured resting upon mats, usually of straw. They form a slight, tender covering or rind, and the interior, generally yellowish white, is in the earlier stages of the firmness of freshly made butter. Slight differences in preparation, time, and temperature, and in the atmospheric conditions during curing, produce the characteristics of the several varieties. Some of these are kept until quite old before connoisseurs consider them ready to eat. Another section of the soft French cheeses are those made to be eaten while quite fresh, and some without salt, including the Neufchatel, Bondons, Gervais, Malakoffs, Cream, and Double Cream. All of the above were exhibited by numerous makers at the temporary shows, and the best of their kinds received gold and silver medals. The grand prize was awarded to the Godefroy factory, known as the Laiterie d'Orbiquet, in Calvados, for its display of several varieties of cheese, especially Camembert, and to the Pommel establishment in Seine-Inférieure, for its Fromages Crème. Simply to show the habit of multiplying names, the following are given, copied from the cards of French exhibitors placed upon cheeses which differed in no essential particular from one or another of these already named: Metun, St. Florentin, Levroux, Poitiers, Montbrison, Rigottes, Troyes, St. Patrice, Septmoncet, St. Nectaire, Deauville, Fourme d'Ambert, Champenois, and Gex; but these included two or three made of the milk of sheep or goats and thus entitled to special names.

Cheese making is a very important branch of the dairy industry of France. It is estimated that the annual product of cheese of all kinds reaches 300,000,000 pounds, or just about the same as in the United States. To this must be added from 25,000,000 to 35,000,000 pounds annually imported from Switzerland, Germany, Belgium, Holland, and Italy, less 13,000,000 or 14,000,000 pounds exported yearly from France. An annual consumption of about 8 pounds of cheese per capita is thus provided for the French people.

Besides the standard products of the dairy, this section of the United States exhibit contained an illustrative display of the methods in which the by-products of dairying are utilized. From skim milk are made dry casein and albumen, and milk sugar is extracted from whey. The plain casein is adapted to food purposes in a form called "egg-powder," but very much more used in making a sizing for paper and a water-mixed paint. The sugar of milk and albumen are of application in pharmacy and have other commercial uses. All the solids of milk other than fat are also extracted in a powdered, soluble, and digestible form under the name of "nutrium," which is in much demand for adding to the quality and food value of baking products. This method of utilizing skim milk seems destined to become extensive and a very valuable adjunct to dairying. The largest and most varied exhibit of this character was contributed by the W. A. Hall Chemical Company, of Vermont, and was awarded a gold medal. The National Nutrient Company, of Jersey City, contributed to both the permanent and temporary exhibitions, and to this promising new food product and its inventor both gold and silver medals were awarded.

The only other article given any prominence at the exposition as a dairy by-product was a form of dried casein called protein, exhibited by an English company. There was quite a contest as to whether this should be recognized as a useful preparation or not, but it was finally given a silver medal.

This description of the exposition of dairying at Paris would not be complete without mentioning the presentation which was made of the condition and extent of the industry in the United States. This com-

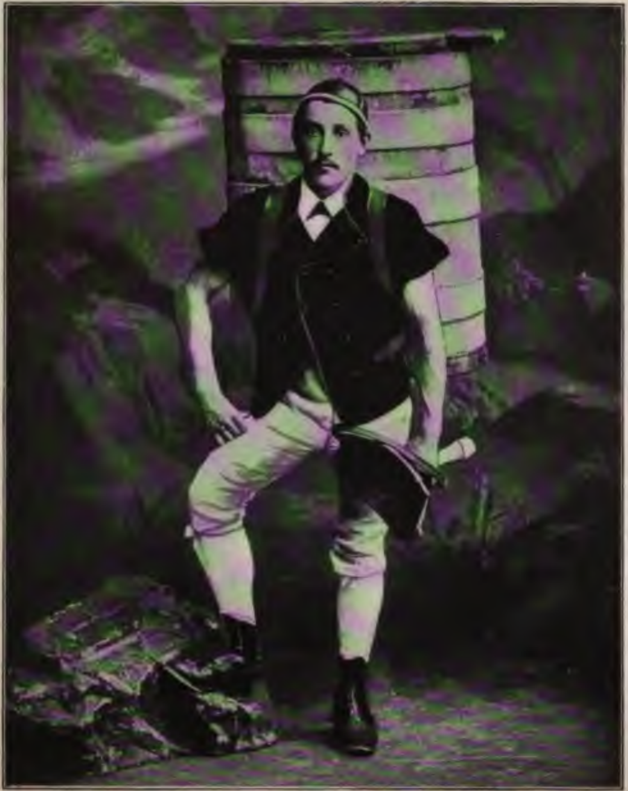


Fig. 1.—From the Mountains—Carrying Milk to the Cheese Factory in Switzerland.

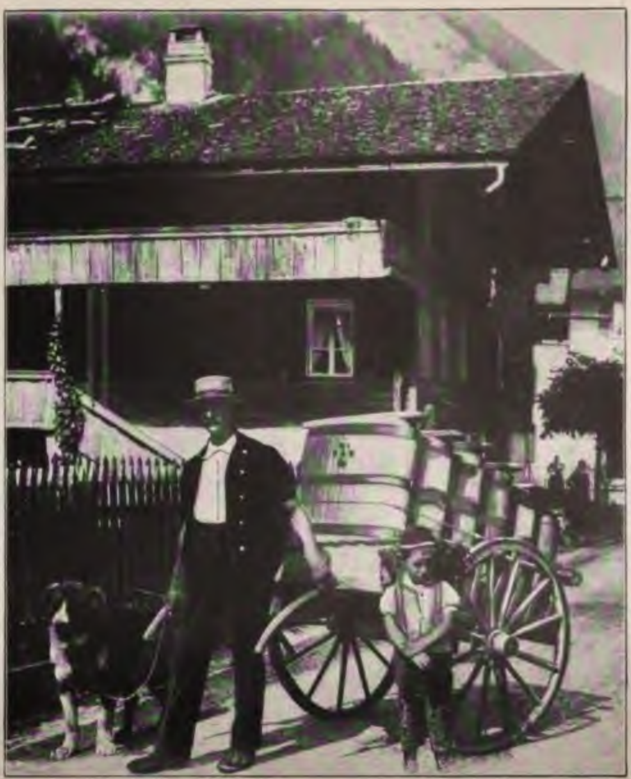


Fig. 2.—In the Hamlet—Carrying Milk to the Cheese Factory in Switzerland.

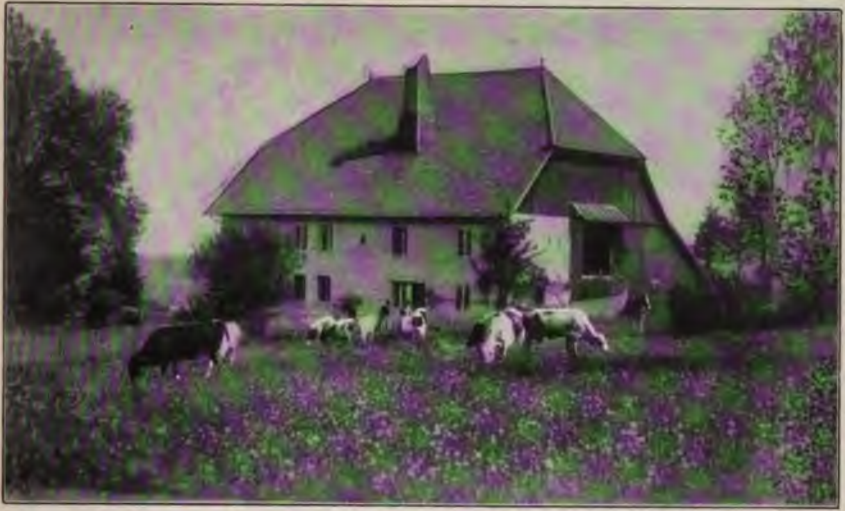


FIG. 1.—EMMENTHAL CHEESE FACTORY IN SWITZERLAND.

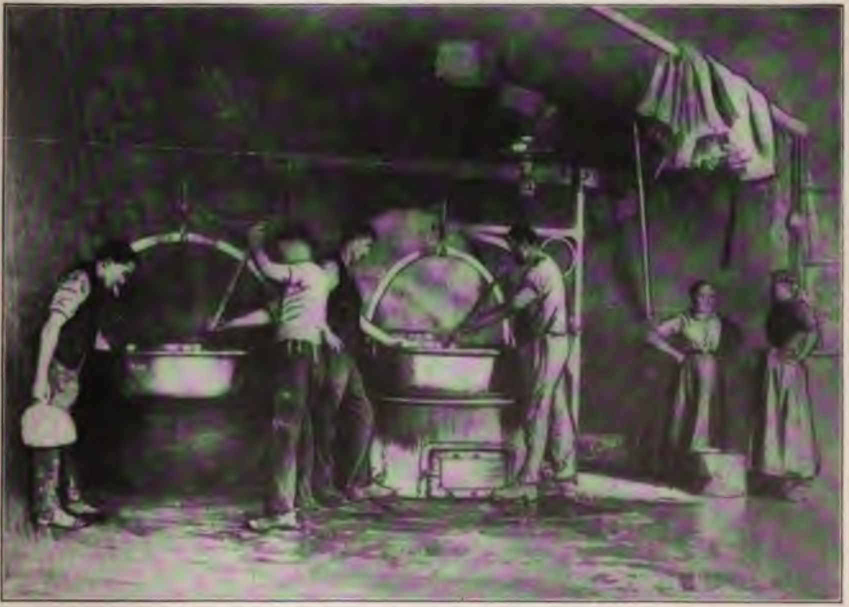


FIG. 2.—COOKING THE CURD FOR EMMENTHAL CHEESE.

(Both of the above figures apply equally to the Gruyère cheese industry in the Jura Mountain region of France.)

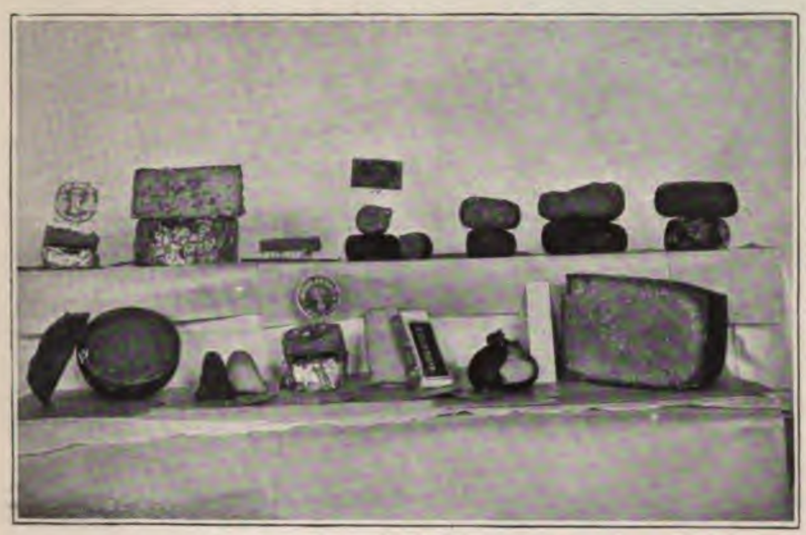


FIG. 1.—VARIETIES OF EUROPEAN CHEESE.

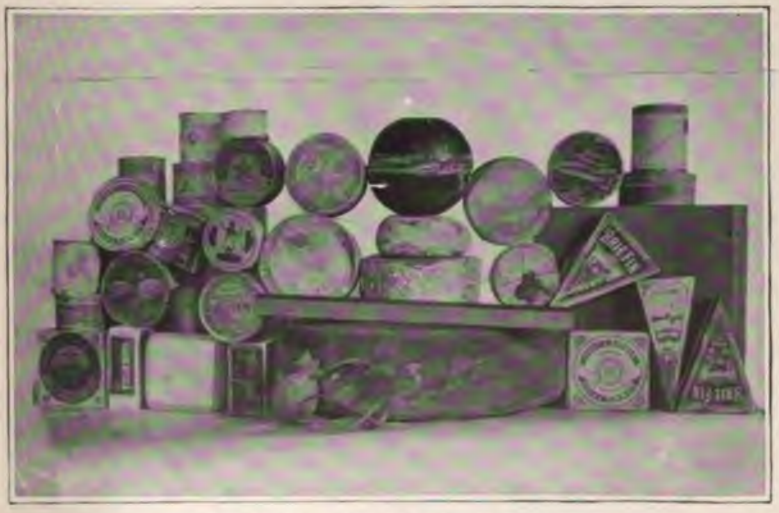


FIG. 2.—VARIETIES OF EUROPEAN CHEESE.

prised fine photographs of dairy cattle—of the buildings, equipment, and operations of several successful dairy schools—exterior and interior views of representative creameries and their work, and maps and statistical data. There was also a complete historical illustration, by photographs, of the development of the Babcock Milk Tester, which has contributed so much to economize and promote the dairy interests of the United States during the last ten or twelve years. In this connection it may be stated that, by special action of the superior jury, the grand prix d'honneur of the Paris Exposition was awarded to Dr. S. M. Babcock, of Wisconsin, as a fitting acknowledgment of this invaluable invention, and also of his having made a gift of it to the public. The statistical maps showed the number and distribution of dairy cows in the United States, according to the latest available data, and the number and location of creameries and cheese factories in Iowa and New York. These two States were selected as being the largest producers of butter and cheese, respectively. For similar illustrative data, by counties, four maps were added. Jefferson, Sheboygan, and Green counties in Wisconsin, and Freeborn County, Minn., were chosen for this purpose. Jefferson shows the creamery system developed to a remarkable degree, and Freeborn well illustrates the rapid growth of this industry in the newer dairying districts of the Northwest. Sheboygan and Green are representative counties, respectively, for large production of the standard American factory cheese and of the American imitations of some of the softer foreign varieties.

This report has intentionally omitted reference to dairy machinery and appliances in general exhibited at Paris by the United States and other countries because those articles belonged to an entirely distinct class of the Exposition.

LIST OF AWARDS MADE TO EXHIBITORS OF DAIRY PRODUCTS FROM THE UNITED STATES AT THE UNIVERSAL EXPOSITION OF 1900 AT PARIS.

Diplomas of the Grand Prize of Honor (6).

1. Borden's Condensed Milk Company, New York—for the "Eagle;" "Peerless," and other brands of condensed milk.
2. Sam Haugdahl, New Sweden, Minn.—for creamery butter.

3, 4, 5, and 6. The Secretary of the United States Department of Agitculture, Bureau of Animal Industry, Dairy Division, Washington, D. C.—for the collective exhibits of dairy products in the permanent exposition (June) and at the temporary dairy shows of May, July, and September.

Diplomas of the Gold Medal (38).

(a) For natural milk and cream:

1. Briarcliff Farms, Briarcliff Manor, N. Y.
2. Fairfield Dairy Company, Montclair, N. J.
3. Stephen Francisco, Montclair, N. J.
4. H. B. Gurler, Dekalb, Ill.

(*b*) For condensed milk and cream:
5. Pacific Creamery Company, Los Angeles, Cal.
6. St. Charles Condensing Company, St. Charles, Ill.

(*c*) For butter:
7. Albert Lea Dairy Association, Albert Lea, Minn.
8. Briarcliff Farms, Briarcliff Manor, N. Y.
9. Cornish Creamery Company, Cornish Flat, N. H.
10. Deerfoot Farm Dairy, Southboro, Mass.
11. Hampton Cooperative Creamery Association, Easthampton, Mass.
12. Iowa Agricultural College Creamery, Ames, Iowa.
13. W. I. Noyes, Moland Cooperative Creamery Association, Moland, Mi
14. Pine Tree Creamery Company, Sherman Mills, Me.
15. Simpson, McIntire & Co., Boston, Mass.
16. Aage Vind, Litchfield Creamery, Litchfield, Minn.

(*d*) For cheese:
17. Ed. Bissonette, Shoreham, Vt.
18. Chandler & Rudd Company, Cleveland, Ohio.
19. A. D. De Land, Sheybogan, Wis.
20. J. A. Ennison, Eldorado, Wis.
21. Milton Fassett, Martinsburg, N. Y.
22. W. A. Freeman, Gouverneur, N. Y.
23. J. F. Howard, Haverhill, Mass.
24. La Crosse Cheese Company, La Crosse, Wis.
25. A. F. MacLaren Imperial Cheese Company, Detroit, Mich.
26. Edward Norton, Goshen, Conn.
27. Ohio State Dairy School, Columbus, Ohio.
28. Alvah L. Reynolds, New York, N. Y.
29. E. S. Rice, Triumph Dairy Company, Triumph, Ohio.
30. N. Simon & Co., Milwaukee, Wis.
31. C. E. Udell & Co., Chicago, Ill.
32. S. Underhill, New York, N. Y.
33. John Voght, Orihula, Wis.
34. Wisconsin State Dairy School, Madison, Wis.
35. New York State Paris Commission (collective).

(*e*) For by-products of dairying:
36. J. H. Campbell, National Nutrient Company, Jersey City, N. J.
37. Casein Company of America, 74 John street, New York City.

(*f*) For collaboratory services:
38. Raymond A. Pearson, assistant chief, Dairy Division of Bureau Animal Industry, United States Department of Agriculture.

DIPLOMAS OF THE SILVER MEDAL (52).

(*a*) For natural and sterilized milk and cream:
1. H. B. Gurler, Clover Farm, Dekalb, Ill.
2. Russell Cream Company, San Francisco, Cal.

(*b*) For condensed milk and cream:
3. Helvetia Milk Condensing Company, Highland, Ill.
4. Vermont Condensed Milk Company, Richmond, Vt.

(*c*) For butter:
5. Armour & Co., Chicago, Ill.
6. Bark River Cheese Company, Hebron, Wis.
7. J. K. Bennett, Clinton Falls, Minn.
8. R. H. Bent, Adams, N. Y.
9. Bridgewater Hills Creamery Company, Bridgewater, Conn.

(c) For butter—Continued.

10. John B. Candon, Pittsford, Vt.
11. Chesterfield Creamery Company, Chesterfield, Mich.
12. College Creamery, State Agricultural College, Ames, Iowa.
13. Dairymen's Union of California, San Francisco, Cal.
14. Elgin Creamery Company, Chicago, Ill.
15. Foster's Creamery Association, Frost, Minn.
16. Hoard's Creameries, Fort Atkinson, Wis.
17. La Belle Jersey Dairy, St. Charles, Minn.
18. La Grange Creamery Company, Lagrange, Ga.
19. C. C. Lawless, Shady Hill Cooperative Creamery Company, Montpelier, Vt.
20. H. H. Leach, Upland Farm, North Brookfield, Mass.
21. Meridale Farms, Meredith, N. Y.
22. I. Walter Mitchener, Glen Hall, Pa.
23. Monadnock Farms, Monadnock, N. H.
24. Montague Cooperative Creamery Association, Montague, Mass.
25. Rockdale Creamery, Rockdale, N. Y.
26. Rosemary Creamery, Adams, N. Y.
27. W. D. Saunders (College Creamery), Blacksburg, Va.
28. Benjamin Sharpless, Westchester, Pa.
29. Silver Lake Cooperative Creamery, Scandinavia, Wis.
30. Smith Creek Creamery (F. S. Rembe, maker), Vega, S. Dak.
31. H. T. Sondergaard, Litchfield Creamery, Litchfield, Minn.
32. M. Sondergaard, Casey, Minn.
33. South Platte Creameries, York, Nebr.
34. Wells River Creamery, Wells River, Vt.
35. Vernon Creamery Company, Rockville, Conn.

(d) For cheese:

36. Rhodes Babcock, Chippewa Bay, N. Y.
37. F. X. Baumert, Antwerp, N. Y.
38. Beatrice Creamery Company, Lincoln, Nebr.
39. A. & H. E. Cook, Denmark, N. Y.
40. Dairymen's Union of California, San Francisco, Cal.
41. F. E. Dawley, Fayetteville, N. Y.
42. F. P. Dunaway, East Rodman, N. Y.
43. D. A. Goodrich, South Champion, N. Y.
44. W. W. Hall, Gouverneur, N. Y.
45. Fred Harvey, Gault, Cal.
46. Lewis Labrach, Ragersville, Ohio.
47. William A. Lawrence & Son, Chester, N. Y.
48. P. McDonough, Hinesburg, Vt.
49. Robert L. Norton & Co., Attica, N. Y.
50. Richardson, Beebe & Co., East Aurora, N. Y.
51. Jared Van Wagenen, jr., Hillside Farm, Lawyersville, N. Y.

For by-products of dairying:

52. The National Nutrient Company, 79 Hudson street, Jersey City, N. J.

DIPLOMAS OF THE BRONZE MEDAL (28).

a) For condensed milk:

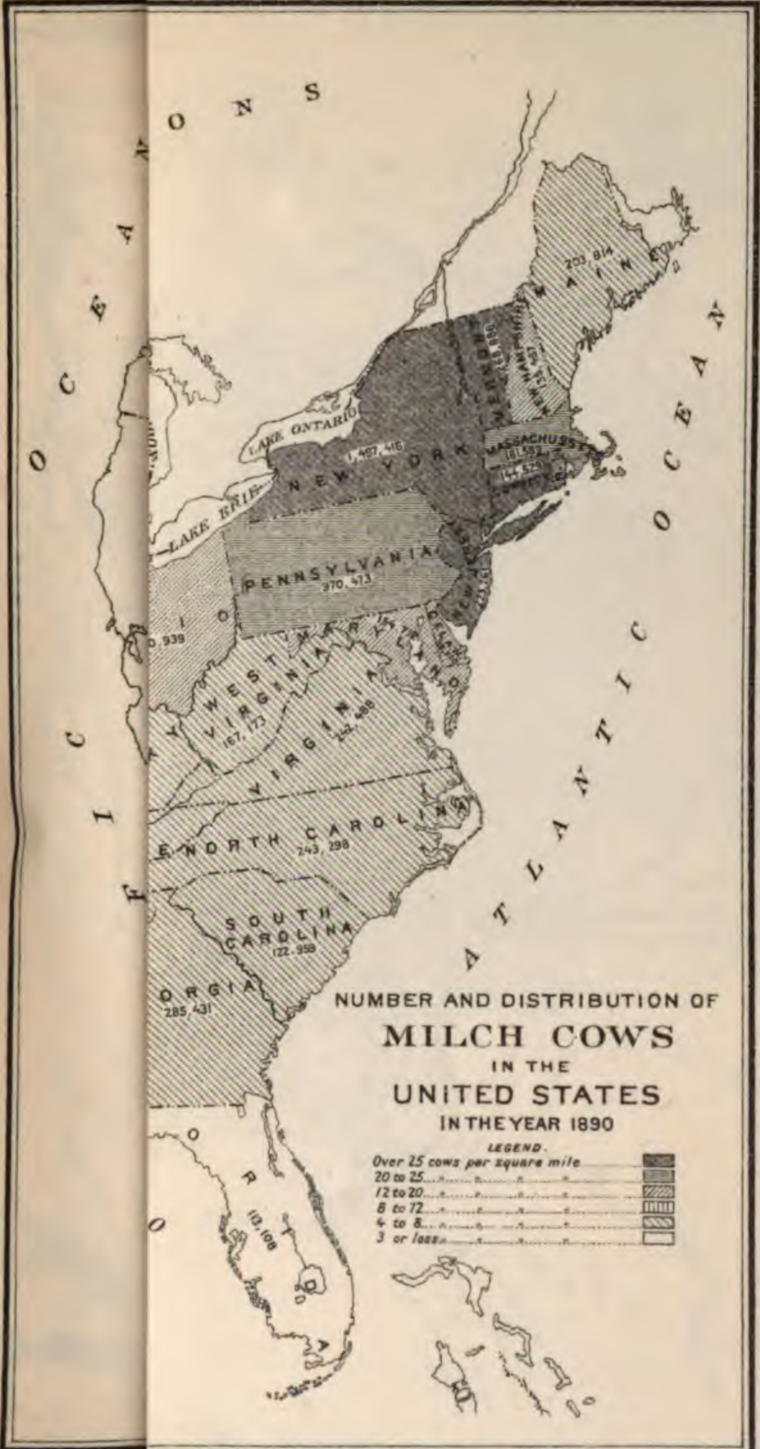
1. American Condensed Milk Company, San Francisco, Cal.
2. Maine Condensed Milk Company, Whitefield, N. H.
3. Pacific Coast Condensed Milk Company, Seattle, Wash.

(*b*) For butter:

4. William V. Beach, Charlotte, Vt.
5. Briarcliff Farms, Briarcliff Manor, N. Y.
6. Henry Eibert, Otisco, N. Y.
7. Elgin Creamery Company, Chicago, Ill.
8. Charles W. Embich, Lancaster, Ohio.
9. H. J. Evans, Humboldt, Iowa.
10. Farmers' Cooperative Creamery Association, Collins, Iowa.
11. Franklin County Creamery Association, St. Albans, Vt.
12. Hoard's Creameries, Fort Atkinson, Wis.
13. Meridale Farms, Meredith, N. Y.
14. Mrs. J. R. Miller, Ryegate, Vt.
15. Monadnock Farms, Monadnock, N. H.
16. Montague Cooperative Creamery Association, Montague, Mass.
17. Mrs. Carrie J. Nelson, Hillside Dairy Farm, Ryegate, Vt.
18. Oscar W. Reed, Lebanon Creamery, Lebanon, Ohio.
19. Mrs. C. H. Robbins, St. Charles, Minn.
20. Rosemary Creamery, Adams, N. Y.
21. Sanborn Creamery, Leavitts Hill (Deerfield), N. H.
22. Benjamin Sharpless, Westchester, Pa.
23. H. M. Slater, Fairmont, Minn.
24. Spring Brook Creamery Company, Chicago, Ill.
25. Vernon Creamery Company, Rockville, Conn.

(*c*) For cheese:

26. F. X. Baumert, Antwerp, N. Y.
27. Lewis Labrach, Ragersville, Ohio.
28. Alvah L. Reynolds, New York, N. Y.



NUMBER AND DISTRIBUTION OF
MILCH COWS
IN THE
UNITED STATES
IN THE YEAR 1890

A. HOEN & CO. BALTIMORE.

MEATS AND MEAT PRODUCTS AT THE PARIS EXPOSITION OF 1900.

By Henry E. Alvord, C. E.,

Chief of the Dairy Division, Bureau of Animal Industry, in Charge of the United States Animal Industry Exhibit at Paris.

The class to which "preserved meats" were assigned at the Universal Exposition of 1900 included also preserved fish, vegetables, and fruits. It is difficult, therefore, in reporting upon that part of this general exhibit which was of animal origin to escape some reference to the other parts, and the results can not be given with absolute accuracy because of this broad classification. In some cases the award to an exhibitor of meats or meat products was more or less affected as to its grade by other articles shown by the same person or company in the same class. The jury made the award to the entire exhibit entered under the same name, without designating which portion had most weight in determining the result. Thus, one exhibitor might have a straight line of food products of animal origin of great variety, while in another exhibit in the same class preserved vegetables and fruits, or perhaps fish, preponderated, and the awards were the same to both. In reviewing only those features of the display comprehended by the title of this report it is consequently impossible to state exactly in all cases the recognition given by the jury to the products under consideration. "Preserved meats" was held to include all meats and their products in form for human food, preserved by refrigeration, salt, smoke, cooking, canning, drying, or by any other successful method. The variety in this branch or division of class 58 of Group X was therefore very great. Dairy products were not included, being given a place by themselves in class 40 of Group VII.

Soon after the duty of preparing and supervising the exhibit in question was assigned to the Bureau of Animal Industry it became evident that the space to be available at Paris would be so limited as to make it impossible for special exhibits and exhibitors to have anything like the space which enterprising houses had been accustomed to occupy in American expositions. Hence it was decided to make a collective exhibit from this country, comprehensive in its variety and commercial in character and form, but including only the products of representative establishments. This precluded any spectacular display or such massing of commercial products as a number of exhibitors would have been pleased to make. Invitations were first extended to nearly all the large general packing houses of the country, but only five finally decided to contribute. A considerable number of packers of food specialties also consented to take part in the exhibit, and arrangements were made by which certain parties sent particularly designated articles to give symmetry and comprehensiveness to the whole.

The Secretary of Agriculture was determined from the first to make an exhibit of the fresh dressed meats of the United States as prepared for foreign markets by refrigeration, and also of other fresh animal products, such as dressed poultry, game, and eggs. This effort was made possible by an agreement between the United States Paris Commission and The Liquid Air Refrigeration and Power Company, of Boston, to jointly bear the expense of constructing at Paris a large refrigerator. This was built on Chase's cold-air-blast principle and was maintained throughout the exposition at the cost of the commission. It was a hexagonal structure, 20 feet in greatest diameter, with ice tanks and refrigerating apparatus in the center, and divided into sections, so as to present six show fronts about nine feet square. This display refrigerator was the only thing of its kind in the entire exposition. It formed a central figure of the American agricultural exhibit and attracted much attention. Many visitors seemed as much interested in the refrigerator itself and its powers of preservation as in the varied products which it at all times contained. Provision was thus made not only for fresh meats and poultry, but for all dairy products and for pickled meats in wood, for lard, hams, bacon, and sausages, which needed protection of this kind during the heat of summer.

Arrangements for a periodical supply of fresh meats were made with the Schwarzschild & Sulzberger Beef Company. Dressed beef was supplied from their abattoir at Kansas City and mutton and pork from their New York establishment. This company controlled refrigerated compartments on the steamships of the American Line between the ports of New York and Southampton. The beef company prepared selected quarters and carcasses, took them to Southampton, and held them there in cold storage subject to the order of the representative of this Department. The Department had portable refrigerators made, large enough to hold a side of beef, to carry the meat safely from Southampton to Paris. The American Express Company received the refrigerators on arrival at Paris, conveyed them to the Exposition building within a few yards of the display refrigerator, transferred the meats quickly to the latter, and returned the empty cases to Southampton. It took some time and much attention to get all arrangements into good running order, but when done the meats moved along over the indicated route, subject, however, to various hindrances and obstructions after reaching the French shores, as will be later explained. The beef was thoroughly chilled and held in cold storage about ten days before leaving New York. Placed on the vessel there on Monday, it usually reached Paris on Saturday of the week following, and was consequently twenty to twenty-five days from the slaughter when hung in the display refrigerator. It was then uniformly in prime condition. According to the efficiency of the latter, the meat could be kept in good show form for a week to ten days, or until about time to remove it to make room for a fresh arrival. Had it been possible to hold the temperature as low as desired, the meats would have kept well for a month. In this manner the choicest of beef, mutton, and pork, representing the meat supplies of the United States preserved by refrigeration, arrived periodically at Paris, and were kept on exhibition during the greater part of the season. Cards were attached to the meats showing the places and dates of slaughter, and thermometers were hung so as to show the temperature of the air by which the preservation was effected. Of course no salt or chemicals of any kind were used, and the meat was not frozen at any time. Supplies of dressed and frozen poultry were similarly received and exhibited periodically, including turkeys, geese, ducks, capons, fowls for roasting, and chickens for broiling. The poultry was especially and attractively packed for the purpose by Messrs. Priebe & Simater, of Minonk, Ill. The poultry could not be kept frozen after reaching Paris, but gradually thawed out in the refrigerator, and therefore could be shown only for a limited time. Eggs preserved, like the meats, by low and uniform temperature, were supplied to the exhibit from stock packed in April by the house of Boardman Brothers, of Nevada, Iowa.

This display refrigerator with its contents was of constant interest, and caused great astonishment to visitors. It attracted much attention not only on the part of merchants and provision dealers, but by householders and citizens generally of France and other countries. In many parts of Europe domestic refrigerators are unknown, and merchants are almost equally ignorant of refrigeration as a means of preserving perishable food products. In Paris during the unusually severe summer of 1900 the losses of butchers' meats were enormous simply from the lack of ordinary methods of refrigeration. On one Saturday in July 30,000 pounds of fresh meat was condemned by the sanitary inspectors at a single large market in the city of Paris. As a result of this experience, combined with the lessons of the Exposition, of which this American meat exhibit was a potent factor, a Government commission has been constituted by the French ministry of agriculture to investigate and report upon the economy of refrigeration and cold storage as related to producers, commerce, and consumers.

The exhibit from this country of meats and meat preparations more lastingly preserved by salting, smoking, drying, cooking, and canning was large and extremely varied, embracing the entire line of products of this class common to our domestic and export trade. Besides the general collection of hams, bacon, lard, and canned goods, supplementary exhibits were made, as follows: A great variety of sausages by the German-American Provision Company, of Chicago; pickled beef, pork, tongues, etc., in casks, by Libby, McNeill & Libby, of Chicago; edible fats and oils by Swift & Co., of Chicago; fertilizers and by-products, such as bones, horns, hoofs, and hair, by the Armour Packing Company, of Kansas City, and many other by-products of the packing house business, by Armour & Co., of Chicago, including meat extracts, pharmaceutical preparations, glues, gelatines, and soaps.

Large cases were filled with attractive exhibits of food specialties of animal origin, nearly all sealed in tin or in glass. Among these may be mentioned soups in great variety from the Armour Packing Company, the Joseph Campbell Company, Curtice Brothers & Co., the Franco-American Food Company, J. H. W. Huckins & Co., and the Van Camp Packing Company. Canned meats, poultry, game, and table delicacies were supplied by several of those already mentioned, and also by N. Goetjean, the IXL Tomale Company, and Kapp & Street, all of California, and by Richardson & Robbins, of Delaware. The Anker Manufacturing Company contributed bouillon capsules and like specialties, J. W. Beardsley's Sons the "Acme" sliced smoked beef, and the Imperial Packing Company sliced bacon, ham, and dried beef, in sealed glass jars. Fine exhibits of edible gelatine were made by the Michigan Carbon Works and by Charles B. Knox.

Complementing this large collective display of animal food products, was an effective exhibition intended to show the resources of the United States in this respect and the facilities and methods of the immense dressed meat and packing house business; also illustrating the system of Government meat inspection. Although belonging technically to other classes in the catalogue of the Exposition, these articles were an integral part of the general collection arranged by the Bureau of Animal Industry. The Department of Agriculture contributed maps, charts, and statistics showing the number and distribution of farm animals in this country, and a large number of photographs illustrating ranch life, feeding establishments, and the breeding and rearing of food animals; also of typical examples of animals of this class. A collection of equipments, material, certificates, other forms, records, reports, etc., explained the work of the Bureau of Animal Industry in inspecting live animals and animal products, intended for export from the United States. The Union Stock Yards Company of Chicago sent a very large photograph of their plant, with smaller and supplementary pictures and charts of statistical data of the yards. Armour & Co. supplied, at an expense of many hundred dollars, a fine set of large panoramic views showing the progressive operations of converting cattle and hogs into dead meats and their products, from arrival at the yards until ready to pass, in various forms, into commerce and consumption. This entire series of photographs was handsomely reproduced in small engravings and the prints were daily distributed to interested visitors, sometimes several thousand in a day. There was also a very large collection of excellent photographs giving views of the exteriors, interiors, and operations of nearly all the important packing houses in the United States. Owing to a great number of these pictures, they were necessarily arranged in portfolios kept in cabinets prepared for the purpose. Swift & Co., in conjunction with Libby, McNeill & Libby, made two special exhibits costing several thousand dollars and which proved to be of much popular interest. One was a complete model, about 12 feet square, of a large Chicago packing house; it was lighted throughout by a multitude of miniature electric lamps, and by looking through the hundreds of little windows, one could see the operations of the business in progress, carried on by a series of intricate electro-mechanical movements. The second was an equally complete model of a refrigerating railway car; the sides of the car were of glass, and it contained a full load of little models of fresh meats and meat products. This was a great novelty to most of the European visitors. The large display refrigerator, already described, was itself a part of this section of the American exhibit.

The international jury which examined the articles above described collectively and in detail and recommended the awards was composed of 22 members, with nationalities as follows: France, 10; United States, 2; Denmark, Germany, Greece, Japan, Norway, Portugal, Russia, Servia, Spain, and Switzerland, 1 each. One of the American jurors was vice-president. This jury was constituted largely with reference to the extensive exhibits of preserved fish, fruits, and vegetables, but the meat interests seemed to receive a fair share of attention. Only three grand prizes were assigned in this class, none of these being to meat exhibits alone nor to individual exhibits. One was to the Secretary of Agriculture for the collective preserved-food exhibit of the United States, in which the section of animal origin was very prominent. The second was to the collective exhibit of the principal French syndicate of manufacturers of preserved fruits and vegetables, and the third was to the Government exhibit of Greece, containing no animal products. Hence, so far as animal food products were concerned, those of this country received the most distinguished recognition.

This was a just decision. No other country exhibited meats or meat products which could at all compare with the displays from the United States. There were a few exhibits of smoked meats, one from England being particularly creditable and the best of its kind in the

Exposition: also a few very elaborate and attractive displays of European sausages. But otherwise there were comparatively small and inconsequential exhibits of animal foods, and practically nothing except canned goods.

There were awarded in the entire class 59 gold medals, 118 of silver, and 116 of bronze. By far the greater share of these (86 in all) were for French exhibits of preserved fruits and vegetables, and most of the remainder were for like exhibits, and also for fish, from other countries. Thirty-five medals in all were given to exhibits from the United States in this class, and of these 7 of gold, 6 of silver, and 5 of bronze (a total of 18, or more than one-half) were for exhibits either wholly or mainly of animal products. This section of the American exhibit therefore fared as well as could be expected. A full list of the awards in this class will be found at page 234. Closely related to the foregoing were the awards made to exhibitors from the United States in classes 38, 41, 55, and 87, which are added to the same list.

It is difficult to make an ornate and artistic display of tin cans, even although there is great variety in size and in the color of labels, with hams, sausages, and buckets of lard contributed as trimmings. Polished hoofs and horns, well-combed cattle switches, colored gelatines, small jars of meat extracts, and fancy soaps assist in decorative effect of its kind. This American exhibit was, nevertheless, arranged in a sufficiently tasteful and attractive manner, while maintaining simplicity and its essentially commercial character and purpose. After visitors had succeeded in penetrating the very severe and incongruous "façade" of a Spanish fort or monastery by which it was surrounded, they expressed themselves as highly pleased by what was found within. No time was lost in searching among paper plants and garlands of false flowers for what they wanted to find. The articles of every producer or packer were grouped together, and those of like kind were in adjoining cases for convenience of comparison. It was a business-like arrangement and appreciated by business men.

The results of this comprehensive exhibit at the International Exposition of 1900 must be of material benefit to the export trade of this country in meats and meat products. Almost every day merchants from various countries could be found making minute examinations, taking notes of particular products, or forms of products, and the addresses of packers. Applications were numerous from persons who wished to rm business connections with American houses, for the purpose of troducing their goods or increasing existing commerce, in all parts the world. The effect at the French capital itself was marked and uite unexpected. Examples may be stated. An order was given for trial lot of several hundred hams, with the assurance that if these proved equal to the samples examined at the exhibit a contract would be made for 5,000 per month for a year or two for this Paris house.

One merchant bought 100 tierces (of 350 pounds each) of American lard, and this led to a bargain for 2,000 tierces per annum. A Chicago firm closed an agreement with a Paris buyer for 50,000 cases of sausage, of 50 kilos each, or over 5,000,000 pounds. There were the beginnings of large transactions in canned goods in new and desirable territory. The commissary-general of the French army visited the United States animal-food exhibit twice, accompanied by experts from his department, and spent several hours in closely examining various products and preparations. Later he sent his chief assistant with notes for numerous specific inquiries and requests for samples of articles which had elicited special interest. In this, as in numerous other cases, the surplus exhibit material and sample packages, generously and wisely contributed by exhibitors, were used as specimens to very great advantage.

Regarding American fresh meats, the conditions were very different. Wholesale merchants and retail butchers paid much attention to it, acknowledged the superiority of the beef, and were anxious to arrange for a supply. They were confident that they could successfully introduce it in Paris and create a large demand for it on the part of consumers, notwithstanding the refrigerated feature. But the cattle growers of France are naturally much opposed, and the Government of the Republic, ever watchful of her agricultural interests, is so opposed to the introduction of fresh meats and all food animals that everything possible, short of absolute prohibition, is done to prevent this traffic. Accordingly, this novel and attractive part of the United States exhibit was officially disfavored and obstructions were continually encountered. The sanitary inspection regulations are in some respects very severe and they were enforced in a needlessly harsh and arbitrary way. Every carcass of beef, mutton, and pork entering France must be whole, with the lungs naturally attached to the interior; in the case of beef it is provided that the animal may be quartered, but the parts must be so cut as to satisfy an inspector that they belong to the same animal. All fresh meat is inspected at the port of entry, and the inspector then quarters the carcasses of mutton and pork, and from these, as well as beef, removes the lungs, which must be destroyed in his presence. Accordingly, imported mutton and pork *must* be quartered before it reaches any meat market in France, and as it is impracticable to handle beef in sides for long-distance transportation, that is sure to be quartered also. In the French wholesale markets mutton and pork from domestic abattoirs are kept in entire carcasses until sold, and beef kept in sides. Thus it is very easy to distinguish imported meats by their form. Meats from other countries at any distance must necessarily be frozen or chilled, and from time immemorial there has been a strong popular prejudice in French markets against all foods artificially cooled. During eight months of the year the butchers' meats in the Paris markets never become so cool as to be rigid, up to the point of being cut for retail delivery.

Against these sanitary regulations and commercial customs the American meats had to contend. The original plan contemplated fresh supplies every week or two for the Exposition, and the sale of the meats in the Paris markets after being exhibited. Such a course was dictated by economy, as well as by a desire to test the French markets in this way, in addition to the exposition feature of the undertaking. The sanitary regulations were canvassed in advance, and it was assumed that, as a matter of international courtesy, some of the obstructive rules would be waived by France to facilitate this branch of the United States agricultural exhibit; especially so, in view of the meats which would be shown, and the Government supervision of the exhibit. It was plain enough that, for exhibition purposes, only the choicest would be selected to send from America; and, as the display was to be under the auspices of the Bureau of Animal Industry and intended to include an illustration of its methods of meat inspection, every animal would be doubly examined (alive and after slaughter), and every piece officially "tagged" and certified, the pork being microscopically tested in addition. All these facts were fully set forth, and months in advance the United States Paris Commission was asked to present the subject to the French Government and secure such concessions as would enable the fresh meats from this country to be taken directly to the Exposition like any other commodity, and then disposed of in Paris, after a period of exhibit, upon payment, of course, of the usual import duty and city excise. Unfortunately, there seemed to be no appreciation of the importance of this subject at the office of the United States Commission, and weeks after the Exposition had opened no adequate effort had been made to comply with the request. Further postponement then occurred. The French Government politely expressed its regret at finding it impracticable to grant the temporary privileges desired, and the matter was never earnestly pressed in return, although a vigorous protest and appeal was made by the Secretary of Agriculture and forwarded to Paris through the Department of State.

In consequence of these difficulties, the fresh-meat exhibit began later than intended and was more irregular. It required a determined effort and no little engineering to get every lot of meat sent past the several official barriers between Southampton and the display refrigerator on the Paris Exposition grounds. It could hardly have been worse indeed had the customs and sanitary officials been under special instructions to make the passage as difficult as possible rather than to facilitate it. At first the attempt was made to stop the meats at Havre and open the cases for sanitary inspection. If enforced during the heat of summer, this would have been a fatal embargo; but the rights of exhibitors under special exposition laws were insisted upon, and time after time the portable refrigerators were figuratively covered with "the Stars and Stripes" and quietly but doggedly forced along the route and "personally conducted" to their place in the American exhibit. The meats could not well be disturbed while hanging in the United States Government space behind three thicknesses of plate glass, but as soon as the time came to dispose of them more trouble was encountered. They must be inspected and passed by the French sanitary officer, despite the formal United States certificate on every piece, before being sent to market. The sanitary officer refused to come to the Exposition, and the meats must be taken across a hot city, "in office hours," to his post of duty. Being still under bond, a military customs escort must accompany them, and this required various applications, formalities, and fees. If passed by the inspector, the customs officer must be next visited, the meat weighed, voluminous papers prepared and executed, and duties[1] paid in cash. Then the meats might go to the market, but could not be sold until a similar ceremony with the city revenue officials and payment of the octroi[2] of Paris. It was comparatively easy, although it required much time and often vexatious delays, to comply with all formalities and to satisfy the tax officials, both municipal and national.[3] After a time pleasant relations were established with these gentlemen, who courteously arranged to execute the papers and collect the duties before the meats were taken from the refrigerator; but in such case the heavy taxes had to be paid in advance of inspection and without rebate if afterwards condemned on (nominal) sanitary grounds. But the sanitary inspector was fertile in new objections, ideas, rules, and decisions—there was ever a new obstacle to encounter. The first lot of meats which arrived at Paris were without the lungs. Despite strenuous opposition, these were duly exhibited, but when the time came to sell them permission to enter for consumption in Paris was absolutely refused because the lungs were not "adhering naturally" for inspection. This meat was therefore kept hanging on exhibition as long as possible, and then, to avoid entire loss, permission was applied for to feed it to wild beasts at a neighboring show; this was granted, after much hesitation, upon condition that a French Government escort or guards, under high pay from the exhibitor (the United States), should accompany the meats, witness the consumption of all by the animals, and, if bones or other parts remained, further escort them to the place for disposing of such city offal. The result was that this lot of superior American dressed beef and mutton had to be cut up and burned under one of the big steam generators on the Exposition grounds, and even then customs officials had to be summoned and paid to witness the cremation and to certify to this disposition of these bonded goods. After the French regulations were more carefully followed, objection was made to the lungs being discolored and "unnatural" (four weeks after slaughter!), although it was admitted that the meat was all still sound and in prime condition. Then the inspector could not be convinced that the two quarters of beef really belonged to the same animal, although to others the fact was evident, and the parts bore the accurate identifying numbers and corresponding certificates of United States inspectors. After conforming to all the known requirements, and so successfully that no fault could be found, the surprising decision was made that if one quarter of a beef was offered for entry all four quarters of the same animal must come, and so cut as to admit of the parts being unmistakably rejoined and identified. Yet this same rigorous law as to quarters and carcasses (the decree of May 26, 1888, article 4) provides that loins and choice cuts of beef may enter France and be sold without any sanitary inspection whatever, and with no evidence as to the health of the animals or condition of the carcass from which they are cut. Of this, later. Upon one occasion an assistant inspector was induced to come to the Exposition and examine meats unofficially, subject to confirmation at the regular station the next morning; he pronounced them perfectly sound and in fine condition. It was mid-August and necessary to move the meats as expeditiously as possible from the refrigerator to the market. The taxes were all paid in the afternoon, so an early start might be made the next day. The morning proved to be very sultry. Taken from a temperature a little above freezing and carried in a wagon a couple of miles in the humid atmosphere, moisture naturally condensed upon the surface of the meats. Arrived at the inspector's office, he at once observed the little drops on the neck and shoulders of a carcass of mutton which lay at the back of the wagon, insisted that this was "the moisture of decomposition" and promptly condemned the mutton. Plain as was the case, and his fallacy easily shown, he would listen to no explanation, and by his order a subordinate at once cut deep gashes the whole length of the carcass and filled them by a brush with a mixture of gas tar and turpentine. This summary action was taken upon a carcass of mutton of a quality seldom equaled in the Paris markets, and not only absolutely sweet and sound at the time, but in such condition that it could have been kept two or three weeks longer to advantage if hung in a suitable place. Despite all of these difficulties and discouragements, these American meats were exhibited and were afterwards exposed in the central markets of Paris, where they sold at good prices on their merits as well as because of their novelty.

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[1] The French import duties are as follows upon 100 kilos of net weight, this being about 220 pounds avoirdupois: Beef, 25 francs; mutton, 32 francs; pork, 18 francs; dressed poultry, 20 francs; eggs, 10 francs. There is also an inspection fee of 1 franc for same weight.

[2] The octroi, or city taxes, levied upon entering the limits of Paris are as follows per 100 kilos: Beef, mutton, and pork, 11.605 francs; poultry, 30 francs.

[3] GENERAL NOTE.—The total cost of getting foreign meats onto the Paris markets, besides the expense of transportation, and including some additional necessary fees, is very nearly as follows per pound of net weight: Beef, 3.5 cents; mutton, 4 cents; pork, 2.8 cents; and dressed poultry, 4.75 cents.

It was apparent, however, that the Paris markets, even during the period of extra demand because of the many thousands of Exposition visitors in the city, were sufficiently supplied with sides of beef and with all the cheaper parts. So much so that, considering difficulties of transportation during a large part of the year, the peculiar sanitary regulations, and the apparent hostility of the Government to this class of imports, there is no encouragement for large transactions in France during the near future in whole carcasses from this country and American cut quarters. But choice parts of beef are scarce in Paris and high in price at almost all times. The local butchers want what they call a "long loin," taken from a whole side and cut well into both quarters. As stated, these loins are exempted from the general regulations governing the sanitary inspection of imported fresh meats and can go to Paris at all seasons unmolested and without detention if judicious arrangements are made for expedition at the custom-houses. In order to make a practical test on this line, a lot of loins was taken over from Southampton in September in place of quarters and, after a brief stay at the Exposition, was placed on sale at the Paris market. As is the custom there, the meat was sold at wholesale by auction. These loins were short, cut from hind quarters, as usually exported to England, and not from sides. Hence they did not fully meet the fancy of the meat-shop buyers of Paris. Nevertheless, they sold at prices well above what was paid for the best French beef at the same sale. American loins brought 2.80 francs per kilo and the domestic 2.40 to 2.50 francs. This is about 25.5 cents and 22.25 cents per pound, respectively. At that time these loins were quoted at 15.5 cents at Southampton—a margin of 10 cents to pay all taxes (3.5 cents), transportation(?), and afford profit. Hind quarters of good local beef sold the same day in Paris at 15 cents per pound and were worth 12 or 13 cents at Southampton. The selling prices were 15.5 cents for extra mutton and about 14 cents for average quality, with 22 to 27 cents per pound for legs of mutton and close-cut chops. Upon the result of the loin sale described, another lot was soon after bought in London by a French meat dealer and sold in Paris at the same relative rates. A little joint effort by sellers and buyers is apparently all that is necessary to give the higher-priced cuts of beef "from the States" a permanent and commanding position in the markets of Paris. Yet improvements in the present transportation facilities are much needed and also provisions for cold storage in the city.

The domestic supplies of mutton and (fresh) pork seem to be ample and of good quality, without being superior, in all the principal cities of France, so that American meats of these kinds are not yet needed.

There is, however, a good opening for dressed poultry at remunerative prices for about half the year, beginning in November. It must, of course, be dressed and packed to suit the market customs of Paris.

LIST OF AWARDS AT THE PARIS EXPOSITION OF 1900 TO UNITED STATES EXHIBITORS OF MEATS AND MEAT PRODUCTS, IN CLASS 58, GROUP X.

THE GRAND PRIZE:

To the Secretary of Agriculture, Washington, for the collective exhibit from the United States.

GOLD MEDALS (7):

Armour & Co., Chicago.
Curtice Bros. & Co., Rochester, N. Y.
The California State Commission.
Libby, McNeill & Libby, Chicago.
Richardson & Robbins, Dover, Del.
Schwarzschild & Sulzberger, New York.
Swift & Co., Chicago.

SILVER MEDALS (6):

The Armour Packing Company, Kansas City, Mo.
The Franco-American Food Company, Jersey City, N. J.
J. H. W. Huckins & Co., Boston.
IXL Tomale Company, California.
Priebe & Simater, Illinois.
Van Camp Packing Company, Indianapolis, Ind.

BRONZE MEDALS (5):

J. W. Beardsley's Sons, New York.
Joseph Campbell Preserve Company, Camden, N. J.
German-American Provision Company, Chicago.
N. Goetjean, San Francisco, Cal.
Imperial Packing Company, Canajoharie, N. Y.

AWARDS MADE TO RELATED EXHIBITS IN GROUPS VII, X, AND XIV, CLASSES 38, 41, 55, AND 87.

THE GRAND PRIZE:

To the Bureau of Animal Industry, United States Department of Agriculture, for its statistical and illustrative data regarding its inspection service and the animal industry of the United States.

GOLD MEDALS (5):

Armour & Co., pharmaceutical preparations, glues, soaps, etc.
A. J. Chase, Boston, inventions in refrigeration of food products.
Libby, McNeill & Libby, model of packing house.
Swift & Co., refrigerator car for meats.
Swift & Co., inedible fats and oils, etc.

SILVER MEDALS (4):

Armour & Co., photographic exhibit of processes.
Armour Packing Company, exhibit of by-products of packing.
Liquid Air Refrigeration & Power Company, refrigerator.
Michigan Carbon Works, gelatines.

POULTRY RAISING ON THE FARM.

By D. E. SALMON, D. V. M.,
Chief of Bureau of Animal Industry.

The barnyard fowls are regarded by most farmers as a very insignificant part of their live stock; and yet, although so often neglected and forced to shift for themselves, the poultry and egg crop constitutes in the aggregate one of the most important and valuable products of American agriculture. The conditions in this country are such that the poultry industry is capable of indefinite expansion, and therefore able to meet any demands that may be made upon it either by home or foreign markets.

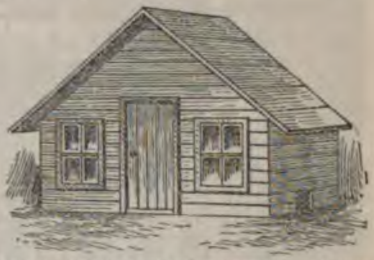

FIG. 7.—Implement house transformed into poultry house.

In order to secure a larger consumption of poultry products per capita in the United States, it is of prime importance that there should always be an abundant supply of strictly fresh eggs and of the best grades of table poultry. This condition is also a necessary factor in the development of the export trade. When the markets are filled with eggs which have lost their quality and flavor by long keeping, and many of which have acquired an offensive taste; when the broilers and roasters offered to the consumer are thin, tasteless, tough, and altogether unfit for the table—it is not surprising that they are passed by, and beef, mutton, or pork taken in their stead. So, also, when the exporter is buying for consignment to foreign markets he must be able to find at all times a good article of eggs or poultry in sufficient quantity or he can not continue his trade.

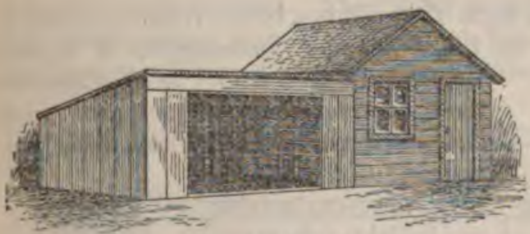

FIG. 8.—Implement house transformed into poultry house.

An increased supply of poultry products of the highest class would unquestionably lead to an increased consumption. There is no more staple and popular article of food, and consequently we may confidently expect the demand to develop in proportion to the increase of our population and to the care and intelligence with which the markets are supplied.

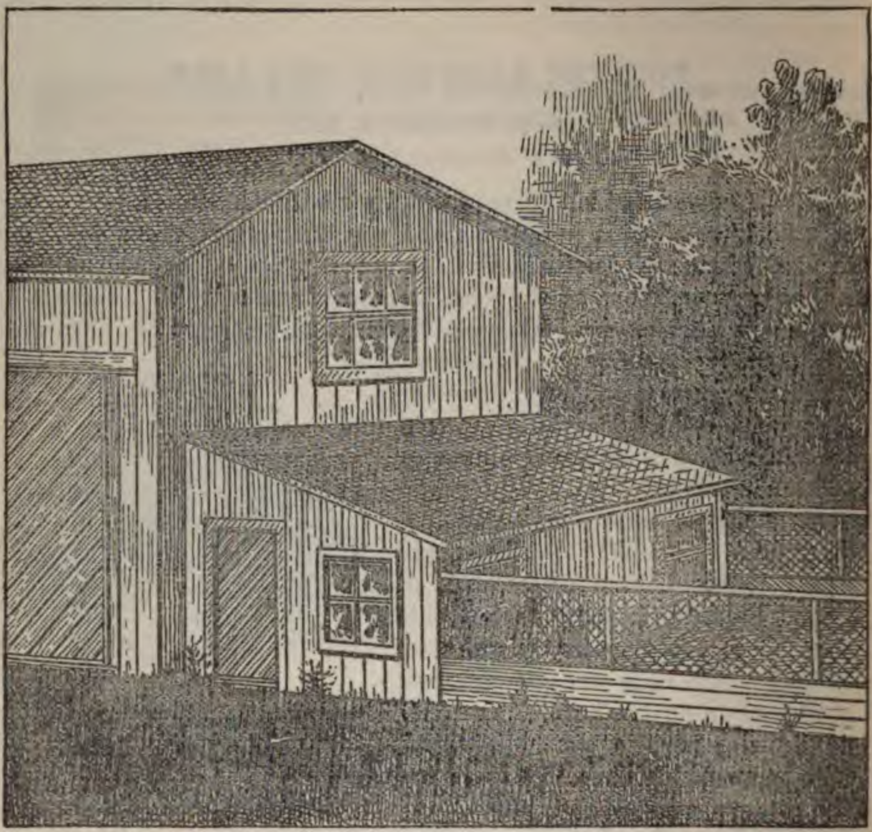

FIG. 9.—A lean-to poultry house.

There is no stock on the farm that yields a better relative return to the food consumed than do the hens, and consequently it is well worth while to consider in what manner their product may be increased without disproportionately increasing expenses. The fowls must have comfortable and healthful quarters, they must have proper food and nesting facilities, but it is not at all necessary that there should be extravagant expenditures in supplying these.

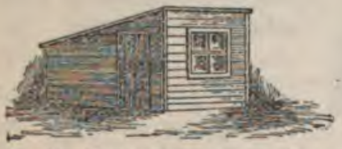

FIG. 10.—Simple form of poultry house.

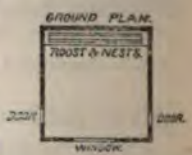

FIG. 11.—Ground plan of simple form of poultry house.

THE KIND OF FOWLS TO KEEP.

The kind of chickens to be kept upon a farm depends almost as much *upon* the kind of man who manages them as upon any other condition.

There are no birds which stand neglect better than the common, mongrel barnyard fowls, for these have lived and developed under unfavorable conditions and are accustomed to shift for themselves. They are generally hardy, vigorous, and yield a fair return in eggs or as table poultry; they respond fairly well to generous treatment, and, if selected with some care, are by no means to be despised, even when their product is compared with that of the standard breeds.

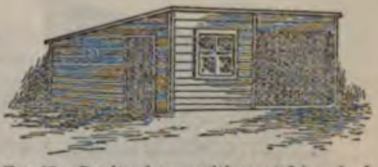

FIG. 12.—Poultry house with scratching shed.

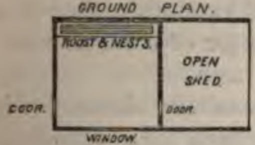

FIG. 13.—Ground plan of poultry house with scratching shed.

The improvement of the common poultry should begin in most cases by breeding from birds selected for their shape, size, and productiveness, and by bettering the conditions of life under which they are kept. If the owner is willing to go a little further and to bestow somewhat more attention upon his birds, he may cross them with males of a standard breed, or replace them entirely by purebred males and females.

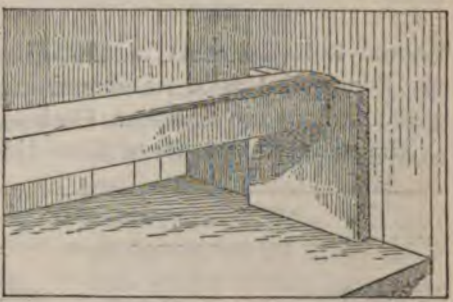

FIG. 14.—Construction of roosts.

The standard breeds have been brought to a higher plane of development by extra care and more skillful management, and if they are to maintain this improvement they must be continued under the conditions which brought it about. They suffer more from neglect and unhealthful surroundings than do the common fowls, because less accustomed to these conditions. The standard breeds, for these reasons, may not always give satisfaction, if their characteristics and requirements are not understood. If, however, the highest returns are expected which care and skillful management can obtain, then a breed of fowls should be adopted which has been bred for generations with this object in view.

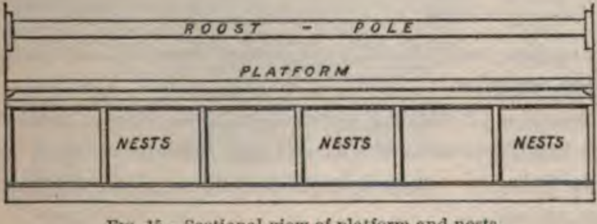

FIG. 15.—Sectional view of platform and nests.

The most popular fowls in the United States are the American breeds known as the Plymouth Rocks and Wyandottes. They are of medium size, good as broilers, good as roasters, good egg producers; the hens are good sitters and good mothers, and for these reasons they are known as general-purpose fowls. In the Barred, Buff, and White Plymouth Rocks, and the White, Buff, Silver, Golden, Black, and Partridge Wyandottes, there is a sufficient range of color to meet almost any taste.

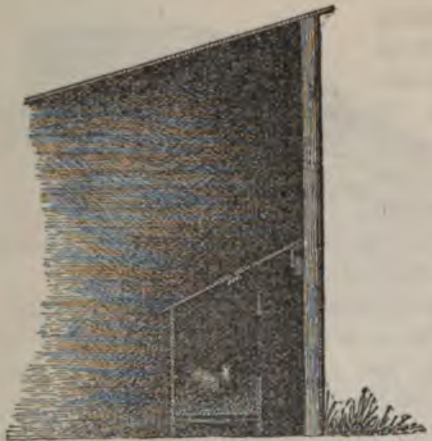

FIG. 16.—Sectional view of concealed or darkened nest.

For farmers who desire fowls more particularly for egg production, the Mediterranean breeds, particularly the Leghorns, Minorcas, and Spanish, are to be recommended. The birds of these breeds are smaller, more active, and greater foragers than the Rocks or Wyandottes, and as layers they are unsurpassed. Should it be desirable, on the other hand, to raise heavier birds than the Plymouth Rocks, we should naturally turn to the Asiatic breeds, which include the Brahmas, Cochins, and Langshans.

The standard weights of these different classes are as follows:

Breeds.	Cocks.	Hens.
	Pounds.	*Pounds.*
Plymouth Rocks	9½	7½
Wyandottes	8½	6½
Light Brahmas	12	9½
Dark Brahmas	11	8½
Cochins	10½ to 11	8½
Langshans	10	7
Minorcas	8	6½
Spanish	8	6½

The Leghorns are smaller than the Minorcas and Spanish and have not been given standard weights.

The Rhode Island Red is a promising general-purpose breed, resembling in size and form the Plymouth Rock. It has been developed by crossing and selection, but has not yet been admitted as a standard breed.

Having in mind the size and peculiarities of the varieties of fowls to which reference has been made, it would appear to be a not difficult matter to select one which would satisfy the requirements of any farm. In purchasing breeding stock it is important to purchase from reliable breeders only, and to ascertain that the stock is in healthy condition and that it has been bred for early maturity, size, shape, and egg-producing qualities rather than for perfection of feathering. For the show room the feathering can not be neglected, as the judges often place it ahead of all other features of the bird's make-up; but for the farm the color and marking of feathers must be held subordinate to the utilitarian qualities. The feathers should not, however, be entirely neglected, as their perfection is an indication of the purity of blood and carefulness of breeding.

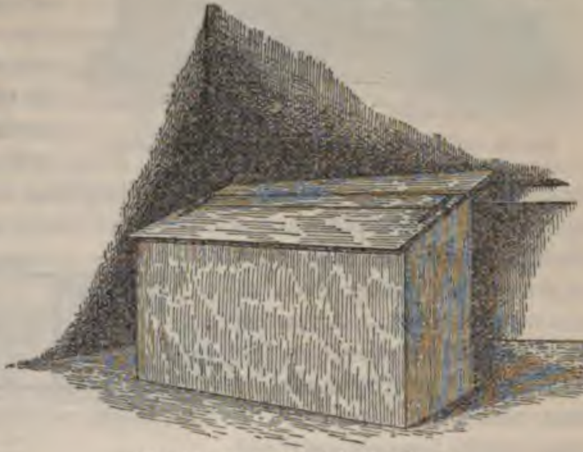
FIG. 17.—Concealed or darkened nest.

POULTRY HOUSES.

It is very desirable that poultry should be provided with a house somewhat separated from the other farm buildings, but near enough to the barnyard so that they can spend a part of their time in scratching for and gathering up the many seeds and grains which otherwise would not be utilized. On farms where no poultry house is provided the hens are compelled to seek roosting places wherever they can find them—sometimes in fruit trees, sometimes on feed racks, sometimes on the farm machinery, or even the wagons and carriages. The result is not only untidiness, but fruit, feed, implements, and wagons are soiled and injured by the droppings, and sometimes vermin swarm in the roosting places to such a degree that the hens are voted a nuisance rather than a desirable part of the farm stock. If these vermin-infested places are near the horse stable, the mites may attack the horses,

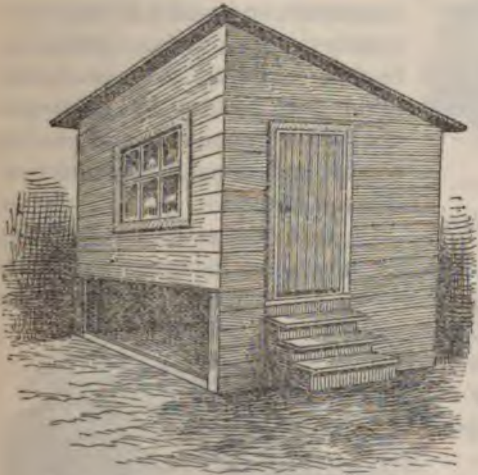
FIG. 18.—Scratching room under poultry house.

causing itching and a mangy condition of the skin, the origin of which is not always suspected.

Poultry houses need not be elaborate in their fittings or expensive in construction. There are certain conditions, however, which should be insisted upon in all cases. In the first place, the house should be located upon soil which is well drained and dry. A gravelly knoll is best, but, failing this, the site should be raised by the use of the plow and scraper until there is a gentle slope in all directions sufficient to prevent any standing water even at the wettest times. A few inches of sand or gravel on the surface will be very useful in preventing the formation of mud. If the house is sheltered from the north and northwest winds by a group of evergreens, this will be a decided advantage in the colder parts of the country.

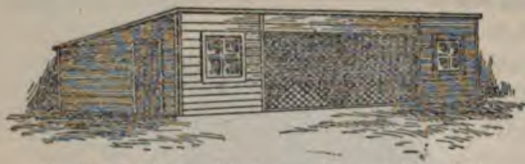
FIG. 19.—Double poultry house with scratching sheds.

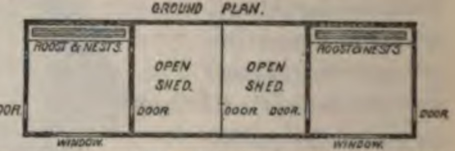

FIG. 20.—Ground plan of double poultry house with scratching sheds.

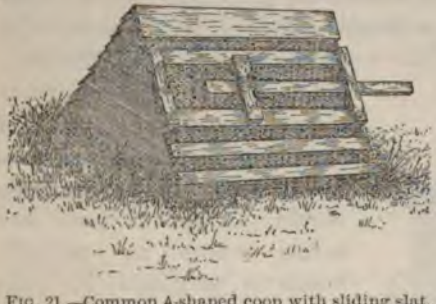
FIG. 21.—Common A-shaped coop with sliding slat.

Sometimes there is already a small building on the farm which has been used for implements or animals and which is no longer required for these purposes. Such a building may be easily fitted for poultry by cutting a small door in one side and placing roosts and nests in the interior. (Figs. 7 and 8.)

In case there is no building suitable for remodeling into a poultry house, an inexpensive lean-to may be built (fig. 9), or a new building constructed. A house for this purpose should be planned with a view to simplicity, economy, and convenience while supplying the conditions proper for successful poultry keeping.

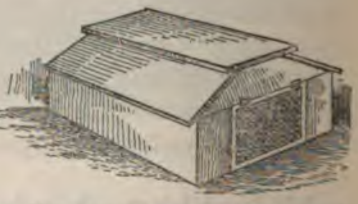
FIG. 22.—A common form of chicken coop.

One of the simplest forms of poultry house is shown in fig. 10, and ground plan of the same in fig. 11. A scratching shed may be attached to the side of this house, as in figs. 12 and 13, which, if desired, may be inclosed in front with poultry wire, so as to keep the birds confined.

The details of construction of roosts are seen in fig. 14. The important points being a nearly flat or slightly rounded surface on the upper side and as few cracks and crevices as possible in which vermin may hide. The roosts may be made of 2 by 3 inch scantling and should be so put in that they can easily be removed at any time for cleaning and disinfection. A platform is often placed under the roosts to catch the droppings and the nests are placed under this platform. In a house, such as fig. 15, the manure platform may be dispensed with and the nest boxes placed along the front or sides of the building.

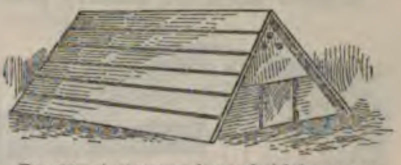
FIG. 23.—A common form of chicken coop.

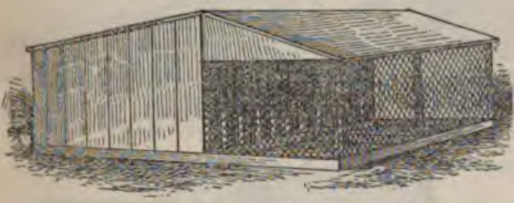
FIG. 24.—Chicken coop with inclosed and covered run.

The simplest form of nest is a box placed upon the floor of the poultry house. With heavy fowls, which are apt to break their eggs in fighting away other hens that try to enter their nests when they are laying and thus acquire the habit of egg-eating, a more concealed or dark nest may be necessary. (Figs. 16 and 17.)

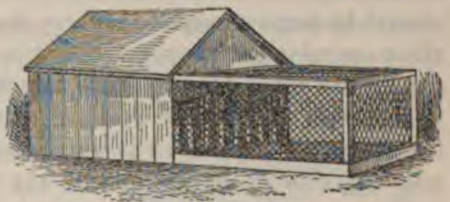
FIG. 25.—Chicken coop with inclosed run.

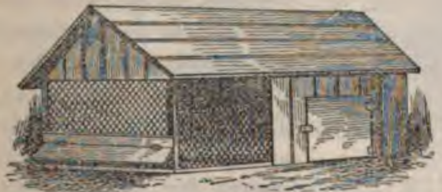
FIG. 26.—Chicken coop with inclosed and covered run.

One of the most troublesome parts of a poultry house to make satisfactory is the floor. Many use earth floors, but these are often damp, especially in cool weather, and then induce rheumatism, colds, roup, digestive disorders, and various other diseases. Some have put in cement floors, but have found these cold and also more or less damp. Probably a good cement floor, laid on broken stone, and covered with a few inches of earth, would be satisfactory, if not too expensive. A board floor, six or eight inches above the earth, with good ventilation under it, is dry but too cold except in the South. A double flooring, laid tightly with building paper between, or a good single flooring covered with a few inches of dry earth is probably the best. In all cases of board floors there should be sufficient space beneath for ventilation and to guard against the lodgment of rats.

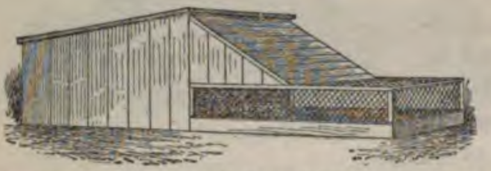
FIG. 27.—Chicken coop with inclosed and partly covered run.

A good style of poultry house, with scratching room under it, is shown in fig. 18. In case more than one flock is to be kept, the plan shown in figs. 19 and 20 have been found satisfactory and may be multiplied to any extent by adding to the ends. With such houses there may be fenced runs at the back or front, or on both sides, so that the birds may be kept confined.

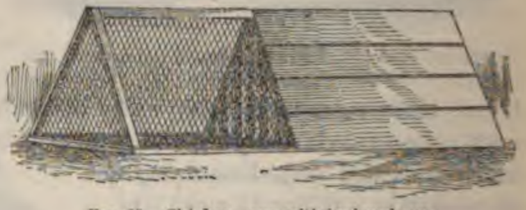
FIG. 28.—Chicken coop with inclosed run.

The amount of space to be allowed for each bird depends upon the size of the birds, whether a shed is attached to the house or whether the fowls have a free run of the open fields. For birds in confinement there should be from 6 to 15 square feet for each adult bird in case there is no shed attached to the house; and with a shed this space may be reduced about one-half. The yards should be large enough to allow exercise in the open air, and to furnish more grass than the birds will eat. This will vary from 60 to 150 square feet per adult bird. The open shed facing the south, where the birds can be induced to hunt for their food and take exercise in all seasons of the year, and where they can enjoy the pleasure of scratching and dusting themselves in the sunshine, even during the winter months, is of great assistance in maintaining the health and productiveness of the flock. The roosting space allowed should be 6 to 8 inches for the smaller breeds, 8 to 10 inches for the medium breeds, and 10 to 12 inches for the larger breeds.

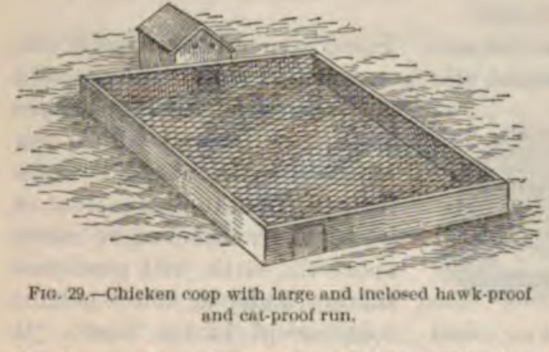
FIG. 29.—Chicken coop with large and inclosed hawk-proof and cat-proof run.

Poultry houses should be well ventilated, but so arranged that drafts of air will not strike the birds. Windows and doors should be provided in such locations that the sun may shine into the building a considerable part of the day. Sunshine is required both to keep the houses dry and to destroy various forms of infection.

POULTRY COOPS.

A liberal supply of coops should be provided for the confinement of hens with broods of small chicks, and for those hens which insist upon sitting at inconvenient times. A few days in solitary retirement will usually break up the desire to sit, and the hen will soon after resume laying.

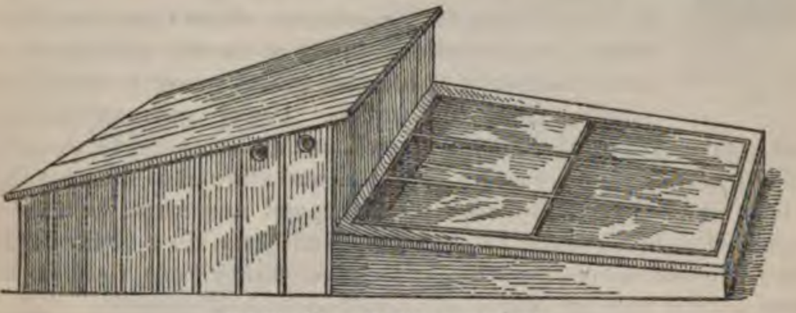

FIG. 30.—Coop with glass-covered run.

The common A-shaped coop is one of the most easily constructed and convenient forms in use. The one disadvantage connected with it is the difficulty of removing the feeding and drinking vessels for cleaning or of catching a bird in it without danger of some of the birds escaping. To obviate this, one of the slats may be made to slide, as shown in fig. 21. The opening made by sliding this slat is sufficient to admit the hand and arm so that any part of the coop may be reached without leaving an avenue of escape unguarded. Other forms of coops for the same purpose are illustrated by figs. 22, 23, 24, 25, 26, 27, 28, and 29. For early hatched chicks, which come out when the atmospheric temperature is so low as to be injurious to them, a combination of coop and glass-covered run, as shown in fig. 30, has been found very useful.

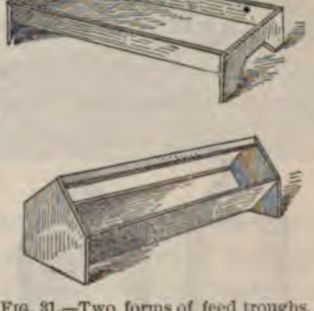

FIG. 31.—Two forms of feed troughs.

Two forms of feed troughs are represented in fig. 31. For small chicks the troughs must be very shallow, or for the first few days the feed may be placed upon a square piece of board. Numerous forms of drinking fountains have been devised, some of which are represented in figs. 32 and 33. A good fountain is easily made by cutting a small aperture in a tin can, as shown in fig. 34, filling the can with water, covering with a shallow pan or vessel of any kind, and then inverting the whole. The shallow vessel will remain filled with water as high as the top of the aperture until the can is exhausted. It is important that fresh pure water should always be accessible to fowls, and the drinking fountains should be cleaned and filled two or three times a day, if possible, and under no circumstances less frequently than once a day.

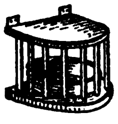

FIG. 32.—A form of drinking fountain.

Poultry may be raised with the greatest economy on the large farms of the country, where there is unlimited range, an exhaustless supply of insects and worms, and an abundance of seeds and grains going to waste which poultry alone can utilize. Under such circumstances fowls take care of themselves so well and are so energetic in seeking their food that they are either forgotten and allowed to shift for themselves when they really need attention and assistance, or they are regarded as a nuisance because they sometimes do a little damage. When fenced away from the gardens and flower beds, fowls do little damage and scarcely cause any annoyance on a farm. On the other hand, they do an immense amount of good in the protection of crops by the destruction of injurious insects, larvæ, and worms.

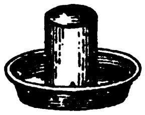

FIG. 33.—A form of drinking fountain.

Sometimes it is advisable to divide the farm flock into colonies and place these at different points upon the farm in order to secure additional range, to remove the birds temporarily to a distance from certain crops, or for other purposes. In this case cheap, light, and easily handled colony houses (figs. 35, 36, and 37) may be constructed and placed where the fowls are desired to range. After being confined in these houses a few nights the birds will adopt them as their habitations and return to them.

POULTRY IN COMBINATION WITH SPECIALTIES IN FARMING.

There are certain special lines of agricultural operations with which poultry raising may be advantageously connected. In dairying there is usually a large quantity of skim milk or buttermilk which may be utilized to furnish a considerable part of the poultry ration. There is also much food to be gathered by the fowls about the stables, manure piles, and pastures which would otherwise go to waste.

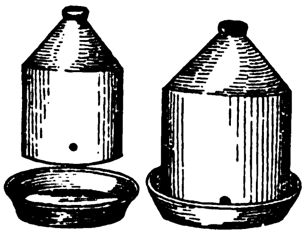

FIG. 34.—A drinking fountain made of a can.

Upon the fruit farm fowls are also of advantage. They keep down the insect pests, and they may have a free range the greater part of the season without the possibility of doing any damage. Plum growers have found poultry especially helpful in keeping down the curculio, and even apples have been considerably benefited. If small fruits are injured, they may, of course, be protected by confining the fowls for the limited season when the fruit is ripening. The waste fruits, either in winter or summer, are a welcome and valuable addition to the poultry ration.

The market garden also furnishes a large amount of waste products which may be utilized for poultry feed. There is the waste lettuce, the small heads of cabbage, the unsold beets, carrots, and potatoes, the peas, and corn which can not be marketed for any reason, the waste of the small fruits, etc. If properly cared for, the hens will bring a steady and reliable income during the winter months. Dried clover and other green feed, roots, and tubers should be saved for them during the summer. These should be steamed and fed with the mash or cabbages, and beets may be fed raw. A catch crop of buckwheat or oats and peas will furnish much food at little expense. Bran, meat, meal, wheat screenings, and oats purchased for poultry will bring good returns in eggs and will also add materially to the fertilizer supply.

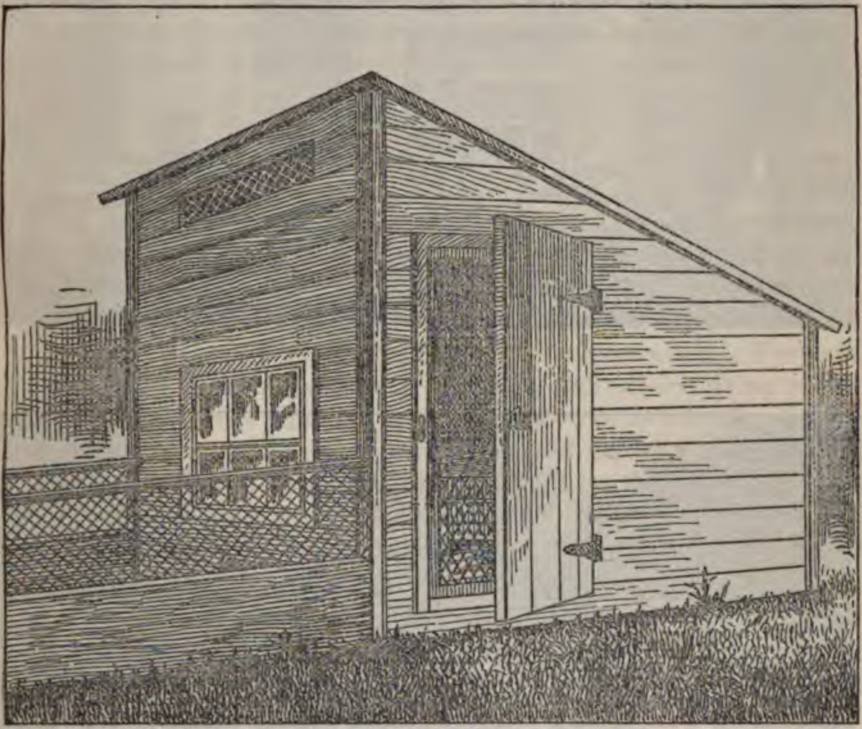

FIG. 35.—Colony house.

Dairymen who have town or city milk routes, and market gardeners who retail their produce, have exceptional opportunities for marketing fresh eggs and poultry at the highest prices. They become well acquainted with many of their customers by their daily visits, and they are looked upon as a direct channel of communication between the country and the city. They should by all means make the most of this advantage, for any class of agricultural producers who can reach the consumer without the intervention of the middleman is indeed fortunate.

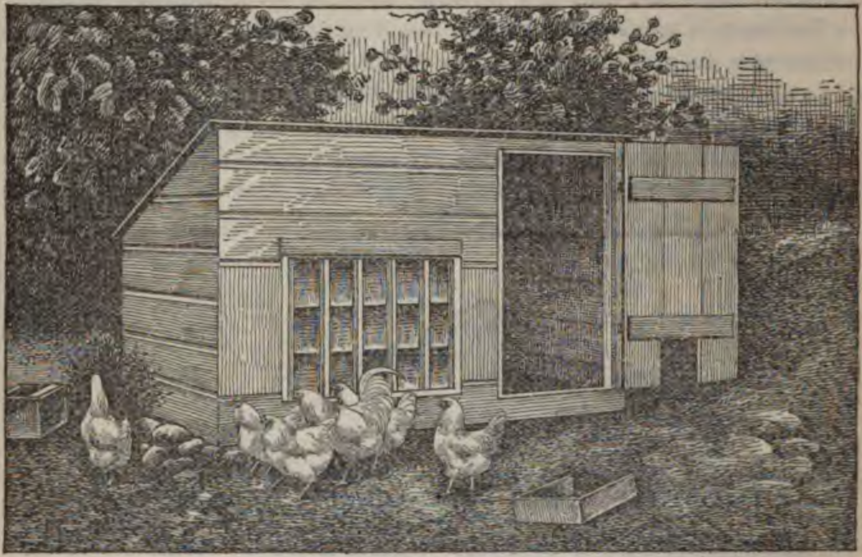

FIG. 36.—Colony house.

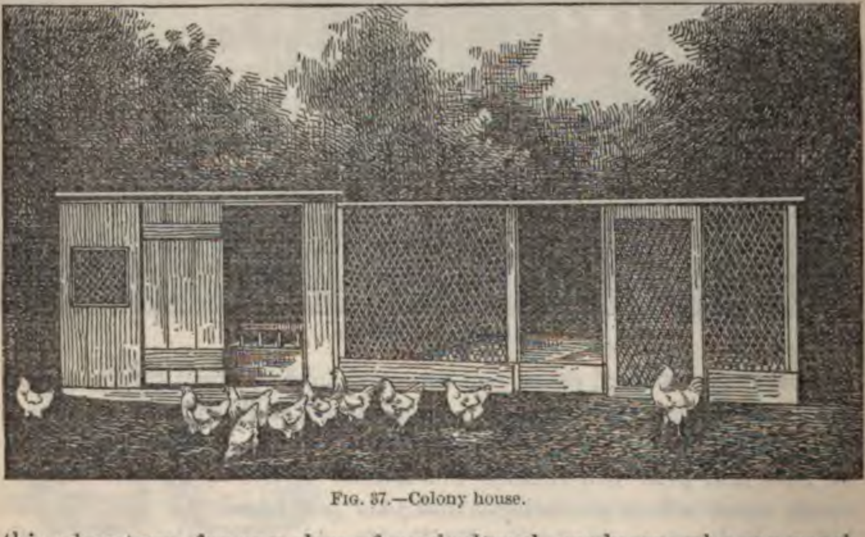

FIG. 37.—Colony house.

CHINESE INCUBATORS.

By G. D. Brill,

Special Agent, Division of Botany.

Throughout China the hatching of eggs by heat is a very large and important industry and has been practiced from very ancient times. For economy of space and fuel, I should consider it far superior to the method practiced in the United States.

BUILDINGS AND EQUIPMENT.

[See figs. 38, 39, and 40.]

The buildings that I have seen are very similar in arrangement, but vary in size and minor details, as the Chinese farmer uses to best advantage the material that he has at hand. The one in which the accompanying photographs were taken was about 84 feet long, 10 feet wide, and 9 feet high to the eaves. The walls on the outside are made of sun-dried brick, about 6 inches thick, and whitewashed. They are plastered with mud on the inside. One side wall adjoins living rooms and is made of reeds plastered with mud about an inch thick. Sometimes all of the walls are made of reeds and mud. The roof is of native tiles, laid very loosely, with some mats on the underside. As in nearly all Chinese buildings, the weight of the roof is supported by the wooden frame inside of the walls, which also helps to support the walls. The floor is of beaten earth.

Completely filling one side—and the other also, except for a door space and sufficient room for a man to test the eggs—are round barrel-like mud-and-brick walls, with earthen jars set into them, very much as an old-fashioned farmer's boiler sets into the brickwork. Fig. 40 will show this better than it can otherwise be described. The jar has either a flange or bulge in it which supports it on the brick and mud wall. It is very deep and comes within 6 or 8 inches of the ground. The conical bottom is filled with ashes to the depth of 8 or 9 inches to keep the temperature more uniform and avoid sudden changes of temperature when doors are opened and there is a strong wind. On the top of the ashes is thrown a bit of an old mat or similar material to keep the baskets of eggs clean and to prevent raising a dust when they are taken out. For holding the eggs a basket is used that leaves a space of about an inch between it and the inner wall of the jar. The top of the basket is on a level with the top of the jar. Rounding full,

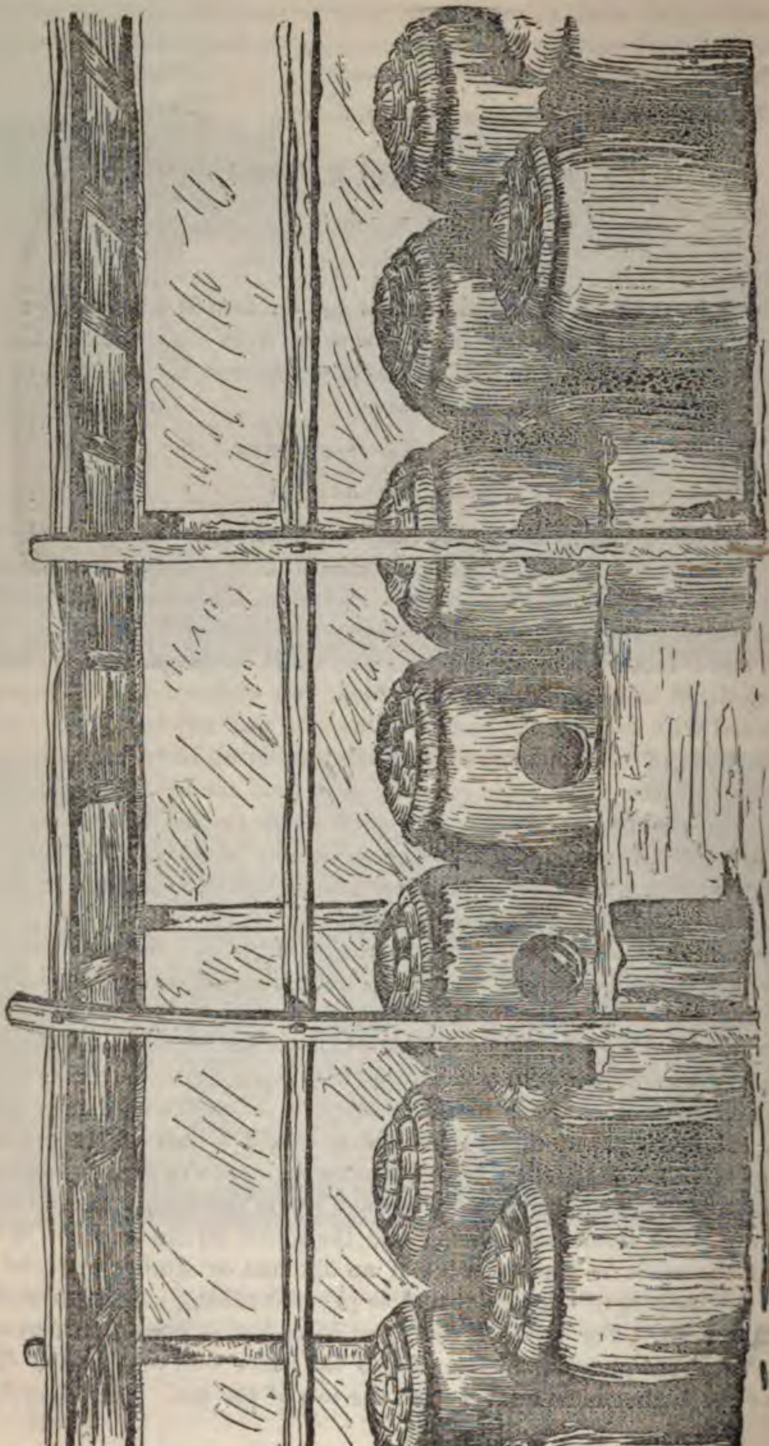

FIG. 38.—Arrangement of Chinese incubators.

they hold from 1,200 to 1,350 eggs each. The outer cover is 3 feet high and 3 feet in diameter. The whole is covered with a thick mat or cover so concave on the underside as to leave a space of about 6 inches between the eggs and the under surface of the cover. This mat is made by taking the dirty old cotton of quilts and making it into a rope-like mass about 2 inches in diameter and then coiling it round and round and binding it with rice straw. When completed it is from 2 to 2½ inches thick.

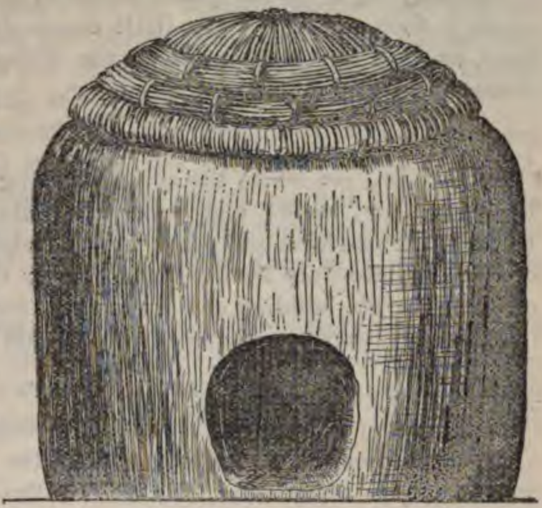

FIG. 39.—A Chinese incubator.

The barrel-like oven or stove has an opening about 1 foot in diameter, for putting in the fuel, the lower edge coming down to the ground.

At a height of 5½ or 6 feet above the floor is a platform the full size of the room, except for a space of 1½ feet, or just room enough for a man between the platform and wall. This is supported by cross-girths mortised into the frame of the building. The bottom is made of reeds about one-half inch in diameter, with spaces nearly as large between them. On these is an old quilt or mat on which the eggs are placed. Around the whole is a raised edge of about 2 inches. One and a half feet above this is another similar platform. Horizontal poles are held by ropes at the right height on which to stand to reach these platforms. The space between the platforms and walls, being so narrow, the man can support himself

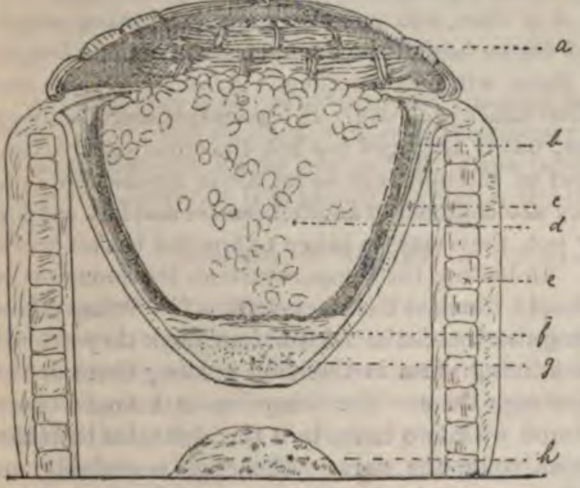

FIG. 40.—Cross-section of Chinese incubator.

by leaning against them and so have both hands free to handle the eggs.

The only light in the place comes from a paper-covered window about 1 foot square. Very little comes from the door, even when open, as that opens into one of the living rooms to avoid sudden changes of temperature on windy days.

COST.

As near as I can learn, the entire building would cost less than $50. Each oven, jar, basket, and cover complete would not cost over $4. Perhaps the platform and other fixtures might cost $6 more, or a total of $80, as there were twenty-two ovens in the room. A very liberal estimate for the building and equipment, including baskets for receiving the eggs, carrying charcoal, etc., would be $100.

EGG CAPACITY.

In this room were twenty-two of these ovens, holding on an average 1,300 eggs each, or a total of 14,300. On the two platforms above were nearly as many more, or a total in the room of over 26,000 eggs, the deficiency being accounted for by those constantly tested out.

The incubators begin running about the middle of March and continue for four months.

METHOD OF HANDLING THE EGGS.

After the eggs are put into the baskets, a slow, smoldering fire made with very fine charcoal is started. After a day the eggs are taken out, a handful at a time, and put into a similar basket which stands on a four-legged frame beside the oven, at a convenient height for a man to change them without stooping. After this they are changed from two to four times each day. If the temperature is about right, twice is sufficient, but if they get too hot the covers are lifted, the mat covers taken out of the openings to let air in around the bottom of the jar, and they are changed to another basket and left out for a short time. If very hot, they may be taken out on flat basket-work trays for a short time. In testing the temperature no thermometer is used, the eggs being simply touched to the eyeball, a few being taken from each basket at irregular intervals. After four days they are all tested to see if there is a living germ in them by holding them up to the light and looking through them. For this purpose a board is set in the wall near the ground with two holes in it the right size to fit the eggs. The men lie down to do the work. The eggs containing no living germs are sold on the street for food at about one-sixth of a cent each (3 cash) or the original contract price of the eggs.

After being tested they are kept in the jars for seven more days, being changed as before. This makes a total of eleven days in the jars. Then they are taken in a bamboo basket, resembling a dustpan, as seen in pl. LV, fig. 2, and rolled out on the mat on the platform above. Here they remain until hatched. The only heat they receive is from the room, except that when the weather becomes cool they are covered with another quilt like the one beneath them. After they are hatched the chicks are put in shallow baskets for a short time to gain strength, and then they are ready for sale.

The average hatch is from 60 to 70 per cent, above 70 per cent being considered very good, and below 60 per cent very poor. After testing, they say that 90 per cent of those remaining will hatch, barring accidents. Sometimes they are tested several times to see if the germ is alive. As with everything else in China, they have no fixed rule for this work.

One man is always in the room night and day, except for very short intervals. The eggs are never sprinkled with water or moistened in any way. Duck eggs are treated in the same way, except that they are left in the jars for fourteen days before being placed on the platforms.

WAGES.

The man who does the testing of the eggs, both as to temperature and fertility, requires long training, but when he becomes an expert he receives very large wages for China. They often get from $17 to $20 per month for the four months; while his helper, a little less skillful, receives about half as much. A comparison of the wages paid these men with those paid a farm laborer will show their large pay. For a year a farm laborer receives only $4 to $5, besides his food and one suit of cotton clothes.

FUEL.

The fuel used is the small pieces of charcoal broken up in transportation. This costs in Hankow about 20 cents per 100 pounds, and is far cheaper than the larger pieces and burns much slower. To make it burn still slower, it is generally covered with ashes, unless the weather is cold.

SUGGESTIONS WORTHY OF CONSIDERATION.

This style of incubator would not suit American requirements, but the idea of utilizing the heat of the room during the later stages of incubation is a very valuable one, as it economizes both heat and space; also the placing of large numbers of eggs together, with the thick walls to keep the heat uniform, is a good one. By putting the eggs in cylinders with cushioned ends, instead of using baskets, they might be turned end for end without handling, but the Chinese consider the airing a benefit to them.

BUYING EGGS.

The eggs are contracted for just before or after the Chinese New Year, and a certain amount of money is paid down at that time. It is supposed to be about half the price of the output of eggs for the season of four months. The price paid is about 3 cash each, or 16 cents per 100. Almost every household, town, or country village keeps a few hens—I should judge from 5 to 20 to the family; but, as each village contains several related families, one contract may cover quite a quantity of eggs. If the incubator owner runs short of eggs, he sends men out to buy them, and in that case he may pay 20 cents or a trifle more per 100.

HOW THE CHICKENS ARE SOLD AND CARED FOR.

The chickens are sold to peddlers, who come to the incubator and buy them. The peddlers pay from 50 to 75 cents per 100, and then take them around the cities and villages and retail them at 1 to 1¼ cents each. They are carried in shallow baskets, one above the other, suspended from the ends of a carrying pole. This is well shown in Pl. L, fig. 1. Very often, instead of receiving money for them, they trade them for old iron, brass, etc. Sometimes they are put with hens, but more often they are kept in baskets for a few days and then allowed to run around the house during a good part of the day. In one or two cases I have seen them in baskets over charcoal fires in cold weather. In one instance I saw a small coal of fire put in their rice so that they might find the rice, or, as the man said, "see to eat it." At a very early age they learn to pick up the greater part of their living. When from two to four months old the roosters, except those kept for breeding, are caponized. This is done by a man who travels about the country for this purpose and who charges about one-sixth of a cent (3 cash) for the operation. Very few ever die from the operation. They bring more than roosters or pullets and are often kept until 18 months or 2 years old. They then weigh from 5 to 7 pounds each.

Many of the chickens closely resemble Brown and White Leghorns and weigh 2½ to 3 pounds each. Those of Honan are much larger. There is no careful breeding, as they all run on the street and mate indiscriminately. They are of all colors and with both smooth and ruffled feathers. The roosters are often kept for breeding purposes until several years old. Very often, in order to prevent the neighbors from stealing them, they dye the white ones fine pinks, blues, greens, etc. This applies both to small chickens and full-grown fowls.

DUCKS.

Ducks are sometimes kept about the house, as are the chickens. In one case I saw the father of a family going to the field with his plow on his shoulder and his wooden shovel in his hand, while the mother followed leading the water buffalo and carrying a duck by its wing, and then came three children, each carrying two ducks by the

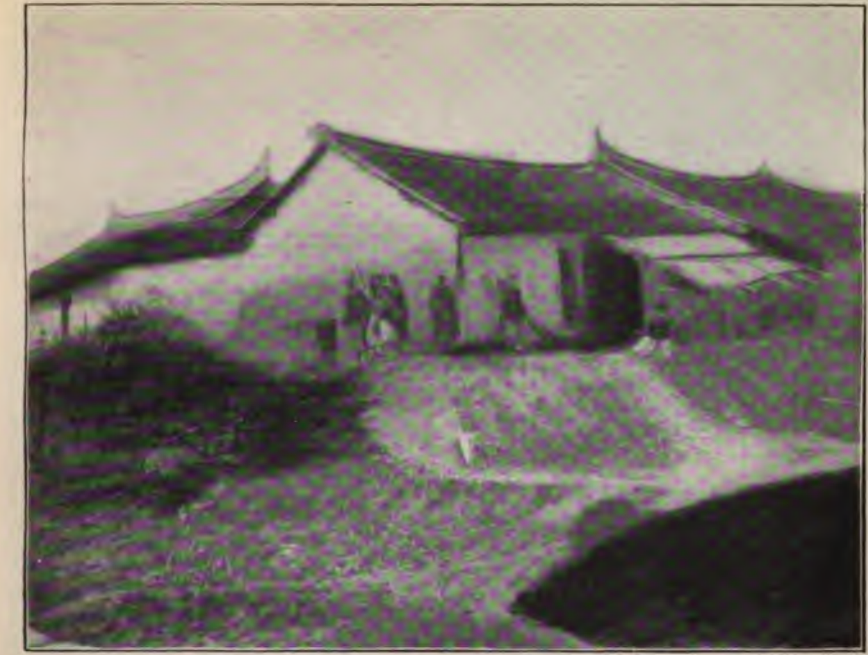

FIG. 1.—OUTSIDE OF INCUBATOR HOUSE.

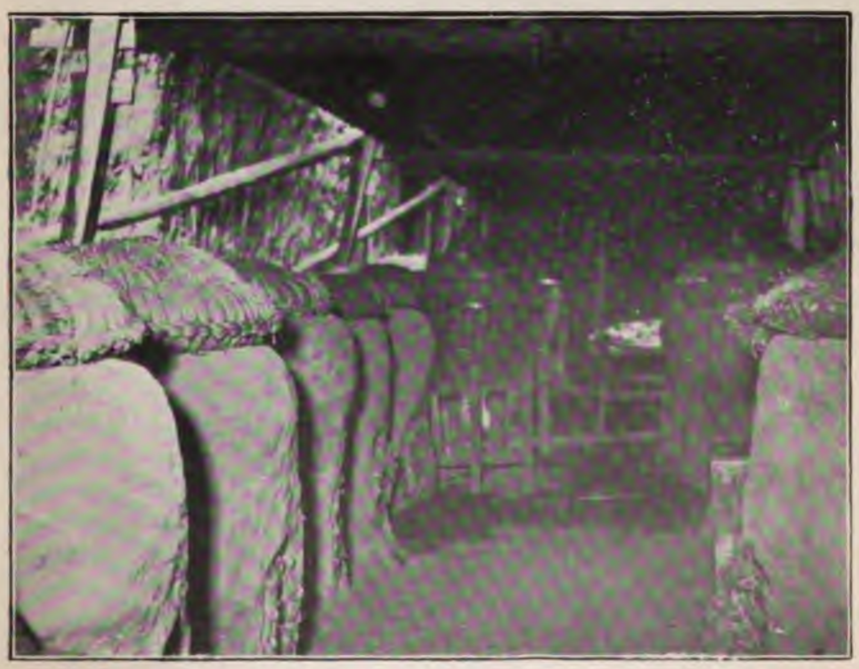

FIG. 2.—INSIDE OF INCUBATOR HOUSE.

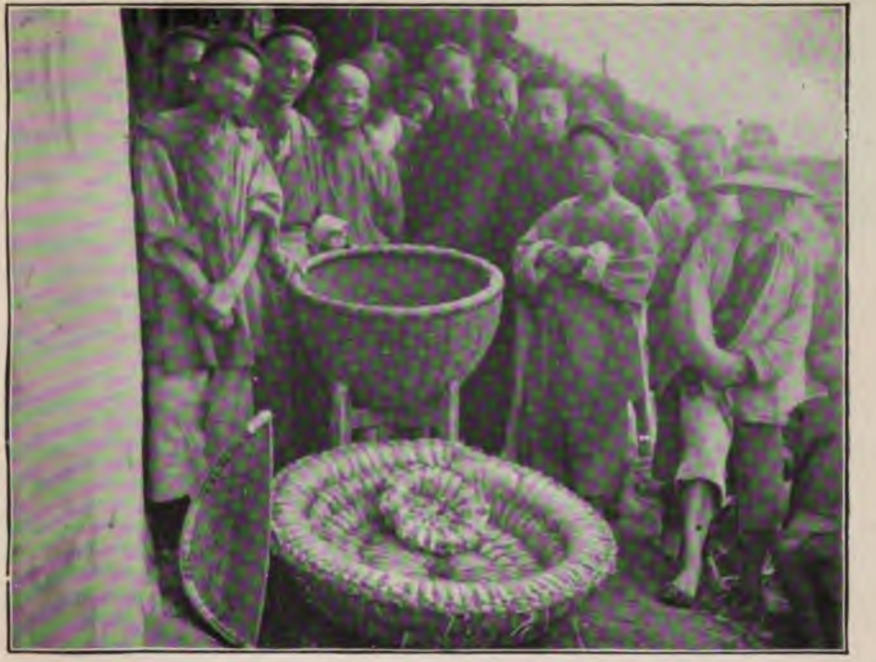

FIG. 1.—BASKETS FOR HANDLING EGGS.

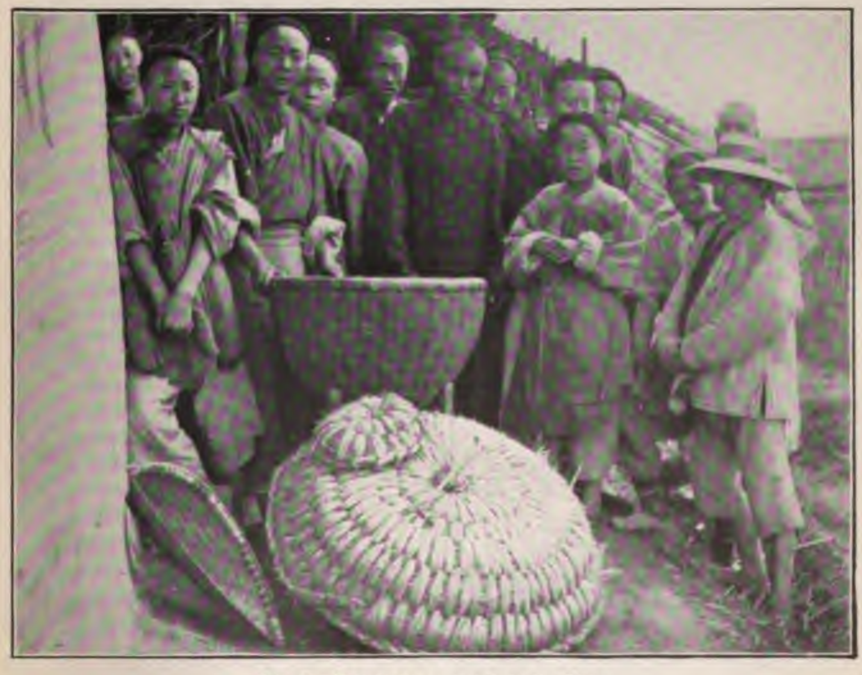

FIG. 2.—BASKETS FOR HANDLING EGGS.

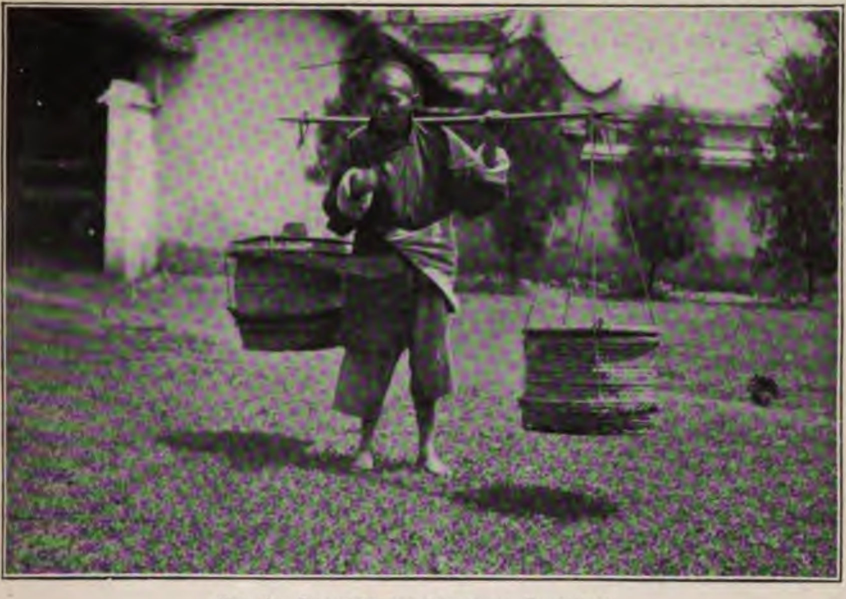

FIG. 1.—BASKETS FOR CARRYING CHICKENS.

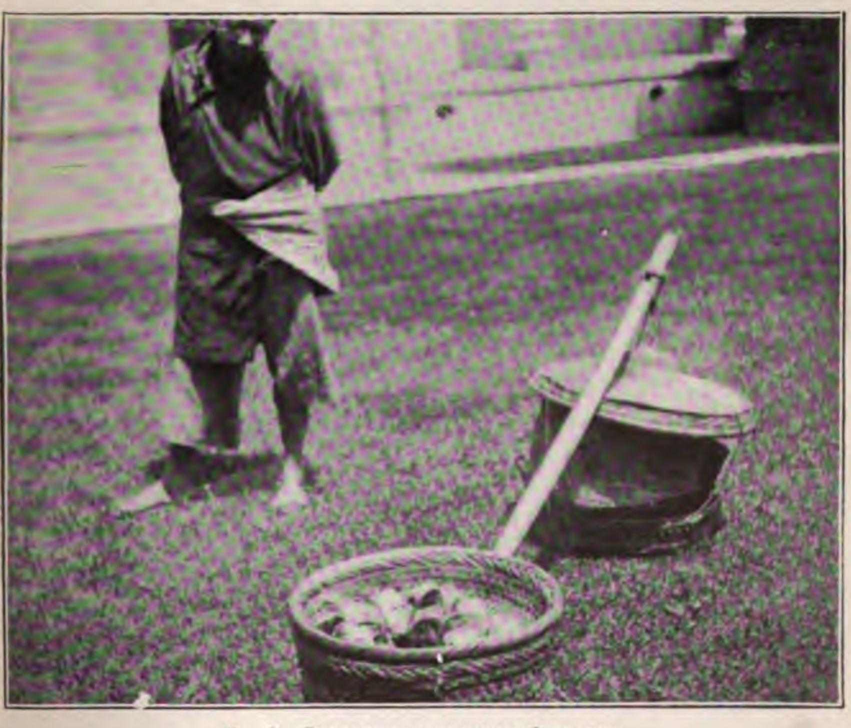

FIG. 2.—BASKETS FOR CARRYING CHICKENS.

wings. They were going to work in the rice fields, and were taking the ducks along to pick up the insects. In this way the insects would be destroyed and the ducks fed. In some places it is a very common sight to see a few in the rice field while it is being plowed. The greater number of ducks here, however, are kept in large flocks, often of several thousands. In this case some point is selected near one of the numerous shallow lakes and a small mat hut is erected. Near this a corral is built of bamboo splints, which can be rolled up and moved like a woven picket fence. This, with one or two very small light boats and a primitive cooking outfit, about completes the camp. Its entire coast, including boats, aside from ducks, should not be more than $7. At 7 or 8 o'clock in the morning they are let out and driven to some good feeding ground in the very shallow water along the lake shore. Here they feed on the aquatic plants and insects until near sundown, when they are driven home by the man who watches them. He uses a long bamboo pole to push along his boat and also to drive the ducks. After they are in the corral they may be given a little rice or brewers' grains or the refuse of nonsaccharine sorghum after the whisky has been distilled off. The larger part of their food is what they pick up themselves.

When making a contract for these eggs the incubator agent generally specifies that one drake shall be kept to every ten ducks. The young ducks are sold from the incubator at 75 cents to $1 per hundred. They are bought by fewer people than are chickens but in larger quantities. They are fed, when very small, the maggots from the manure tanks and receptacles. This failing, they are fed cracked rice. While small they are generally watched by children when not shut up.

In the autumn or early winter the drakes are sorted out and driven to market like a flock of sheep. They are not only driven along the roads, but also on the rivers as well. If only a few are to be marketed, they are carried in open wicker baskets made of bamboo. The ducks are of the small brown and white varieties and weigh from 4 to 7 pounds per pair. So far as I know the drakes are never caponized.

NOTE.—I am indebted to the kindness of Miss E. McCook, of the American Church Mission, Hankow, for the three drawings shown herein.—G. D. B.

THE THIRTEENTH INTERNATIONAL MEDICAL CONGRESS.

By E. A. de Schweinitz, Ph. D., M. D.,
Chief of Biochemic Division, Bureau of Animal Industry.

The Thirteenth International Congress, which was presided over by Professor Lannelongue, held its opening session in the large hall of the Exposition buildings in Paris, on August 4, 1900. More than six thousand doctors from all countries were present, the United States being third on the list in the number of members. Some of her most prominent men from Boston, New York, Philadelphia, Washington, and other cities, were present and received a very cordial welcome. The work was conducted in a number of different sections.

The section of Bacteriology and Parasitology was the one directly in the line of the work of the Biochemic Division of the Bureau, and it was to this section that the Chief of the Biochemic Division was sent as a representative. He had the honor of being one of the vice-presidents, associated with Duclaux, Buchner, Ehrlich, Metchnikoff, Blanchard, Nocard, and others.

One of the introductory papers presented at this section was "A review of our present knowledge of the subject of immunity," by M. H. Buchner, of Munich. The general conclusions of his review are given: Natural resistance and specific immunity present differences of principle. The natural resistance is characterized by the presence of the alexines; the specific immunity, by specific antibodies. The alexines are destroyed at 60° F. They differ according to the species of animal which produces them. The antibodies are stable substances at 65° F. They differ not only according to the species of animal which produces them, but also according to the method of treatment of the animal which is to serve to prepare them, and they present a specific relationship to the object producing the reaction. Alexines and antibodies act in the same body at the same time and often in concurrence. The natural resistance and the specific immunity may join hands, so to say, in their effect in the same organisms, the one reenforcing the efficacy of the other. The recovery of a typhoid case, for example, may be caused by the increase of the natural resistance concurrent with the production of specific antibodies. It is for the clinician to study and to differentiate all the phases of the two processes.

Professor Ehrlich presented a paper upon "Toxins and antitoxins." According to him the fundamental principles which should be considered in connection with this subject are the following: First, the toxins are extremely unstable substances which one finds as products of animal or vegetable secretion. At the present time it is impossible to characterize chemically the toxins because they are extremely labile substances, because they can be obtained in only very small quantities, and because it is difficult to separate them from certain other transformation products which have an analogous constitution. The only criterions which permit of a differentiation are biological in character. These criterions are the reaction, the particular action of the poisons, and the ability to determine in certain cases the formation of an antitoxin. This last property permits of the establishment of an analogy between the toxins and certain enzymes. The toxic action of most of the toxins is characterized by the existence of a period of incubation. Sometimes poisonous substances which have a period of incubation, as snake poisons, approach the toxins in character, in the first place, on account of their ability to form antitoxin; in the second place, on account of their extreme lability. Bodies of definite chemical composition are altogether incapable of producing antitoxins. The statements upon the possibility of obtaining antitoxic serums which are efficacious for inorganic poisons—the glucosides, ordinary alkalies, etc.—rest upon errors of observation. It follows, therefore, that the action of the toxins upon the organism may be essentially different from that of other poisons. We must admit that the fundamental condition of the toxic activity of these substances resides in their ability to form specific chemical combination with the protoplasm of certain cellular groups. Other poisons—for example, the alkalies—obey also a certain law in the action upon the organism, but they differ in that they combine with the parenchymes to form more nearly stable compounds. The specific character of the chemical combination of the molecule of the toxins is due to the fact that this molecule possesses a particular chemical grouping—a haptophore grouping. The fixation of the toxins upon the tissues by the aid of this group, however, does not sufficiently explain the toxic action of these substances. The toxic action necessitates the presence in the molecule of the toxin of a second group—the toxophore group—the influence of which upon the protoplasm is determined by the combination of the haptophore group with the protoplasm. Under certain conditions one may separate the activity of the haptophore group from that of the toxophore group. In fact, Morganroth has proved that in cold-blooded animals the haptophore group of the tetanus toxin is capable of producing cold in its action upon the cells, while the action of the toxophore group causes an elevation of the temperature. The differences in the time of the action of these two groups explains also the reason of the period of incubation. Dönitz and Haymann, following different methods, have determined that the diphtheria toxin and the tetanus toxin act very rapidly upon the tissues, but that in spite of this action the effects of disease appear only slowly. The fixation of the haptophore group of the molecule of the toxin upon the protoplasm results in the formation of certain side chains which may be called *receptors*. These receptors occur also in the normal life of the protoplasm in the sense that they serve for nutrition in aiding the fixation of nutritive principles.

Toxins have this in common with nutritive substances, namely, that they possess, like the last, certain haptophore groups. The receptors exist sometimes only in certain tissues and sometimes in the larger portion of the tissues. The want of receptors in certain species of animals is perhaps a cause of natural immunity. The receptors which are usually constant in the organism may undergo, in certain cases, very considerable variations. From the fact that the receptors of the protoplasm form combinations with the haptophore groups of the toxins, they are of importance to the life and, in particular, to the nutrition of the cells, and therefore to the phenomena of regeneration in the sense that the protoplasm reproduces the receptors which are made unsuitable for use on account of these combinations. Following a general law of biology, this regeneration not only compensates for the loss, but it goes beyond the limit. There is a superreproduction. This superreproduction may be brought to an exaggerated point by the repeated injections of toxin so that at last there is produced a detachment of these receptors in excess and their passage into the circulation. These protoplasmic receptors circulating in the blood constitute the antitoxins. They preserve at this stage their original property of fixing chemically the haptophore groups of the toxins. This theory explains the enormous multiplicity of the antitoxins and their specific character. It is unnecessary to supply another explanation than that of the ordinary physiological processes and there is no need to attribute to the organism an enigmatical invasion. Conforming to their origin, the antitoxins have with the toxins an affinity of a purely chemical nature. The two bodies combine to give place to a new product indifferent to the organism, as the researches of Fraser, Ehrlich, Cherry, and Martin, and others have proved. The bacillus of Loeffler produces two sorts of substances (toxins and toxones), both of which have the property of fixing the specific antibodies and therefore possess the same haptophore group. The complex toxophore of the toxons exercises upon the organism an action very feeble and sensibly different from that of the toxophore group of the toxins, and shows the absence of the necrotizing power and the production of slow paralysis. All diphtheria bouillon contains, in addition, other of the products of the modification of the toxins, having another toxic property, and being capable of fixing antibodies. These are designated by the name *toxoids.* The genesis of the toxoids is due to the fact that the complex toxophore of the molecule of the toxine was much more labile than the haptophore. It is more easily destroyed under the influence of heat and chemical agents. Particularly demonstrative in regard to this point are the researches which have treated of the attenuation of the diphtheria poisons preserved in the liquid state, and which prove that the toxic value of such a bouillon decreases considerably, although its neutralizing property is preserved. It acts in this case as a quantitative modification. It is necessary to admit the possible existence of many species of toxoids corresponding to different origins. Many determinations appear to indicate the complexity of the constitution of the toxophore group. The complete destruction of the molecule of the toxin may be gradual. It is then possible to cause a production of antibodies, not only by neutralizing the toxins, but the toxoids as well. One can, in fact, immunize easily and rapidly against tetanus in animals as susceptible as is the guinea pig by administering the toxoids. When it is necessary, therefore, to immunize sick individuals whose sensibility is increased, one ought to employ, in the first place, the toxoids. From new determinations one is able to see that the two groups (toxophore and haptophore) of the toxin molecule can be found in certain ferments. The hypothesis of Morgenroth in regard to the existence of a haptophore group and the zymophore group in the labile ferment has been recently verified by Myers and Bashford, who have discovered zymoides analogous to the toxoids. Some more recent researches having treated of an important class of cellular poisons, represented in particular by the bacteriolysines, the hemlysines, and the cytolysines (Pfeiffer, Bordet, Landsteiner, von Dungern, Metchnikoff, and Moxter), have shown that the poisons have a complex constitution. According to Ehrlich and Morgenroth the specific immune bodies combine at the temperature of the organism with the more specific complement and give rise to a new product possessed of the toxic properties and which is analogous to the toxins. The immune bodies contain the haptophore group, while the toxophore group is represented by the complement. The fact that the immune bodies offer a specific affinity with regard to the cells (bacteria, red globules, and spermatozoids) which have served for immunization explains the theory of lateral chains, in admitting the existence of receptors possessing two groups which have different affinities of combination. The bacterial immunity and the antitoxic immunity offer, then, many points common to the theory of lateral chains.

A review of the work on toxins and antitoxins for tuberculosis was to have been presented, but the reporter failed to appear.

The writer presented a review of some of the experimental work on tuberculosis, which had been done in the United States, covering some of the most important work in connection with the study of the bacteria and products of the tuberculosis bacillus. As this paper appears elsewhere in this report as a separate article, a review is not necessary here. (See p. 262.)

Many other papers of interest in various lines were presented, but no startling discoveries in any lines were announced.

Laveran, the discoverer of the malarial parasite, presented a review in regard to this organism. He stated that the malarial parasite presents two varieties that one may designate under the names of small and large, according to the dimensions of the parasite, and that the technique applicable to the study of the *Hæmamœba malariæ* has made notable progress in the last years. Koch, Ziemann, Nocht, and Ruge have perfected the method of Romanowski.[1] He continued: "I [Laveran] have indicated a process of coloring the malarial parasite, the employment of which appears to me easier and better than the original or modified method of Romanowski. The researches of Simond, Shaudinn, and of Siedlecki upon the coccidia have explained from a new standpoint the much-discussed question of the flagellæ of the malarial parasite. It has been demonstrated that these flagellæ are male elements. The observations made by MacCullum, Opie, Koch, and Marchoux do not leave any doubt upon this rôle of the flagellæ. In 1884 I suggested the idea that the *Hæmamœba malariæ* occurred outside of the animal organism as a parasite of the mosquito. This hypothesis, which is based upon many presumptions, has been verified by the researches of Ross and completed by those of Koch, Grassi, Bignami, and Bastianelli. All of the anopheles appear to be able to act as a propagator of malaria. One has already been able to determine, in various points of the globe, the coexistence of the anopheles and malaria, while in certain healthy localities one finds only the culex. The anopheles which have bitten individuals infected with fever may infect healthy individuals. One finds in the salivary glands of diseased insects blasts of Ross, which are inoculated with the product of the secretion of the venomous salivary glands. It may be premature to conclude that the malaria is always inoculated in this way. One often contracts malaria in uninhabited places. The fact that excavation and ditching often give rise to an outbreak of malaria is perhaps also sometimes difficult to explain if one admits that malaria is always inoculated by the anopheles (mosquitoes) which have been fed upon the blood of malarious individuals. Certain points still remain obscure. There is no doubt that at the present time in the prophylaxis of malaria the first point to note is the measure for the protection against the mosquito. It is important, also, to prevent the recurrence of fever in those who have been originally infected with fever, so that the sick do not serve as a source of infection for the anopheles. Koch has made in Africa and Java some favorable observations in regard to the existence of an immunity acquired by the inhabitants of swampy countries. This immunity may be due to an attack of fever in early life. A number of facts show that the inhabitants of swampy countries often appear in cachectic condition, which excludes the manifestation of swampy fever, but does not merit the name of immunity. The experiments made so far to obtain artificial immunity against fever have, up to the present time, failed."

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[1] Soc. d. Biologie, 1899, April 15; 1900, June 9.

THE TENTH INTERNATIONAL CONGRESS OF HYGIENE AND DEMOGRAPHY.

By E. A. de Schweinitz, Ph. D., M. D.,

Chief of Biochemic Division, Bureau of Animal Industry.

This International Congress was held in Paris from August 10 to 16, 1900. Coming thus immediately after the adjournment of the International Medical Congress, a large number of those who might otherwise have been present at the Congress of Hygiene had gone. The president of the congress was Prof. Dr. Brouardel, the dean of the medical school of the University of Paris, and the secretary was Dr. Henry Martin. The official delegates from the United States were as follows: Dr. Le Garde, United States Army; Dr. Berthollet, United States Navy; Dr. Rosenau, United States Marine-Hospital Service; Dr. C. O. Probst, American Public Health Association; Dr. E. A. de Schweinitz, United States Department of Agriculture.

The work of the congress was conducted in eight sections devoted to microbiology and parasitology as applied to hygiene—the hygiene of food; the relation of engineering and architecture to hygiene; the hygiene of schools, hospitals, prisons, etc.; hygiene as it relates to industrial and professional pursuits; hygiene in relation to the Army and Navy; the consideration of the precautions of a general international character with relation to transmissible diseases and the laws and administration of laws in relation to their control; and hygiene with relation to the various methods of public transportation—railroads, steamboats, omnibuses, street cars, etc.

No very new suggestions were presented, the greater portion of the time of the different sections being occupied in the discussion of the various plans followed by the different countries in the line of work which the various sections were organized to consider. Some of the papers which deserve especial mention are as follows:

The report of Professor Vaillard, of Val de Grâce, was upon the accidents resulting from the use of spoiled meats and the way in which they may be avoided. When the various forms of gastro-intestinal poisonings occur after the use of meat, two causes may be investigated: Are there any poisonous substances in preserved meats? or, Do preserved meats contain living microorganisms which are capable of producing such an infection? The presence of a poisonous substance in meat may be explained by one of the three following hypotheses: First, the poisonous substances may have been originally contained in the muscles of the animal from which the food was prepared; or, second, the meat originally obtained from a healthy animal may in the course of preparation have become spoiled either on account of the delay in handling it or from carelessness in work which has permitted the invasion of microorganisms; or, third, in the preserved meat insufficiently sterilized the germs may remain alive and develop afterwards. To avoid all of these dangers an inspection, of course, should be resorted to. This is, under ordinary conditions, for general use, practically impossible, and the carrying out of proper work must necessarily be left to the honesty of the manufacturer. At the same time, when the Government is securing large quantities of preserved food for use of the Army, Navy, etc., careful investigation can and should be adopted.

Messrs. Vaillard and Thoinet presented a short review upon pathogenic microorganisms which might be found in the water and the soil, calling attention to the fact that the presence of some of them in the soil is more widely distributed than is generally supposed, and that many of them remain alive for a considerable time.

The paper presented by Probst and Wurtz upon yellow fever gave a brief review of the subject, especially of Sanarelli's work and the relation of icteroides to the disease. The authors considered that Sanarelli had proved that the bacillus icteroides was responsible for yellow fever. (The recent work, however, of the Army board—Reed, Carroll, and Agramonte—which was detailed for the especial study of yellow fever, has shown pretty conclusively that icteroides is not the cause of yellow fever, and that Finlay's theory that the disease is communicated from man to man by means of the mosquito is correct; and that in all probability the cause of the disease is a plasmodium, although at the present time the plasmodium itself has not been discovered.)

Other papers were presented upon the various subjects connected with hygiene. The writer read a paper upon the methods of treating tuberculosis in the United States during the past ten years.

In regard to practical work it may be stated that the methods in general followed by the United States appeared to be equal to, and, in many cases, far in advance of, those followed by other countries.

THE BACILLUS OF TUBERCULOSIS.[1]

By E. A. de Schweinitz, Ph. D., M. D.,
Chief of Biochemic Division, Bureau of Animal Industry.

The announcement of the discovery of tuberculin and its possible application for the treatment of tuberculosis in men, and its subsequent use in diagnosing tuberculosis in cattle, stimulated to a large degree the investigations in connection with tuberculosis all over the world. As much valuable work in various lines, both in the study of human and bovine tuberculosis, has been done in America, it seemed to me that a brief classified review of some of the important American work might be of interest to the members of this congress, and should be placed on record.

The discovery of the bacillus of tuberculosis in 1882 by Koch excited, of course, a great deal of interest, and innumerable confirmatory tests of the presence of this germ in human and animal tuberculosis were made by many. At the same time the investigations have been more fruitful of results since 1890.

Realizing the interest and importance attached to a method of obtaining an idea of the relative number of tubercle bacilli obtained from the sputum of tuberculous individuals, Nuttall,[2] in 1891, reported a method for the estimation of the number of bacilli, depending upon the use of a finely graduated burette, in which the sputum, diluted to a definite amount, was placed. A measured quantity of this diluted sputum was allowed to drop on a slide on which the number of bacilli could be counted, and thus the total number of bacilli in the expectoration of twenty-four hours could be determined. In the same journal and same article, Nuttall reports the results of tests in which he endeavored to determine the virulence of the tubercle bacilli in the sputum of patients that had been treated with tuberculin. The sputum of such patients was inoculated into guinea pigs. Out of the 13 guinea pigs so inoculated 10 became tuberculous, and the results indicated that there was no attenuation of the bacilli in man brought about by the tuberculin treatment.

Later, in 1892, Heiman[3] called attention to the best methods of staining the tuberculosis germ, claiming that Friedländer's method gave the most satisfactory results. In the same year Prudden[1] presented a most interesting review, calling attention to the ways in which tuberculosis might be contracted and the methods of prevention which should be employed to avoid danger. Dorset,[2] in 1899, described a new stain for the tubercle bacillus, by which it could be easily distinguished from other bacilli that might tend to cause confusion.

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[1] Paper read before the section of Bacteriology and Parasitology of the Thirteenth International Medical Congress, held in Paris August 4-10, 1900.

[2] Nuttall, G. F. Bul. Johns Hopk. Hosp., 1891, vol. 2, No. 3.

[3] Heiman, Henry. N. Y. Med. Journ., 1892, Mar. 12.

SOURCES OF INFECTION.

In 1896, Aylett[3] reported experiments demonstrating the presence of tubercle bacilli in fly specks, and suggested the possibility of flies being responsible in many cases for the transmission of tuberculosis. In 1898, Loomis,[4] in an article upon the pretuberculous stage of phthisis, called special attention to the importance of making a careful examination of patients for tuberculosis before the bacilli can be detected, and concludes that a careful consideration of the weight, respiratory capacity, chest measurements, as compared with the height of the person, vital capacity, and the character of the pulse, would throw light upon the pretuberculous stage of the individual, or the possibility of the individual being infected with the disease. In 1898, Baldwin[5] reported a number of cases which showed that tuberculosis infection might be conveyed by the hands. He carefully washed the hands of some patients from the sanatorium who had come to his office, and who, previous to leaving the sanatorium, had washed their hands. During the time of leaving the sanatorium and going to his office they had occasion to make use of perfectly clean handkerchiefs. Baldwin found that the wash water from the hands of these patients contained bacilli which produced characteristic tuberculosis in guinea pigs. The experiments, of course, were made under the most careful conditions, in order to eliminate all possible sources of error, and showed how easily the hands could be infected even by the most careful. Hance,[6] in 1895, pointed out that tubercle bacilli could be detected in the dust from the walls of a room inhabited by tuberculous patients. In 1899, Bissell[7] noticed that several men had left a military organization on account of tuberculosis. In looking over the history of the cases he found that the uniforms and overcoats discarded by an outgoing member of the military organization who was tuberculous were assigned to a new recruit. He thought that possibly these uniforms might transmit tuberculosis. He therefore took the pockets from the uniforms, and had them washed and centrifugalized. The washings and the sediment from the washings were used for inoculating 16 guinea pigs. Two of these guinea pigs died with tuberculosis which they had contracted from the material obtained from the uniforms.

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[1] Prudden, T. M. N. Y. Med. Journ., 1892, Apr. 10.

[2] Dorset, Marion. N. Y. Med. Journ., 1899, Feb. 4.

[3] Aylett, W. R. Va. Med. Semi-monthly, 1896, June.

[4] Loomis, H. P. Med. Rec., 1898, Dec. 10.

[5] Baldwin, E. R. Trans. Amer. Climat. Assoc., 1898.

[6] Hance. Med. Rec., vol. 51, No. 7.

[7] Bissell. Med. News, 1899, Feb. 4.

VARIETIES OF TUBERCLE BACILLI.

In 1894, de Schweinitz[1] reported a number of experiments upon guinea pigs which demonstrated conclusively that the human tubercle bacillus, after cultivation for a number of generations upon artificial media, might lose its virulence and become perfectly innocuous, so far as guinea pigs were concerned, although the original parent germ had been exceedingly virulent, causing the death of the guinea pigs within four to five weeks. At the same time he noted that guinea pigs inoculated with these attenuated germs acquired an immunity that could not be secured in any other way, and that the immunity so secured would either protect the guinea pigs entirely from death by inoculation with a virulent germ or prolong their life for many months. Trudeau[2] confirmed these experiments, showing conclusively that this apparent immunity, as noted by de Schweinitz, was not accidental, but could be secured by inoculation with the attenuated germs obtained by cultivation in his own laboratory from an originally virulent germ. In 1896 de Schweinitz and Dorset[3] noted the growth of the tubercle bacillus upon media that contained a slight excess of hydrochloric acid, and called attention to the readiness with which this germ could be caused to grow upon purely artificial media, and also noted that the apparent spore formation and involution forms are very much more pronounced in germs grown on artificial acid media than on other media. Prudden and Hodenpyl[4] had, in 1891, succeeded in producing tubercular nodules and in causing the death of guinea pigs by inoculating these with dead tubercle bacilli, thus proving conclusively that the cell contents of the tubercle bacilli were the important dangerous substances with which one had to deal in endeavoring to control this disease. As certain conditions are necessary for the lodgment and propagation of the tubercle bacillus in man, all intelligent prophylaxis will look to the maintenance of that normal mechanism in the body which ordinarily repels invasion, and by which, also, the process of spontaneous recovery from developed disease is brought about. Early recognition of disease is therefore very important. Latent tuberculosis has been described as occurring in cases where the disease is present without subjective or objective symptoms, while the transition from latent to manifest tuberculosis may be viewed as an evidence of increased susceptibility or diminished bodily resistance. The importance of detecting this stage of disease is, of course, very apparent. The difficulty of doing this has been largely overcome by using tuberculin as a diagnostic agent.

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[1] De Schweinitz, E. A. Med. News, 1894, Dec. 8.

[2] Trudeau, E. L. Med. News, 1895, vol. 61, No. 10.

[3] De Schweinitz and Marion Dorset, Bul. No. 13, Bureau Animal Industry, 1896.

[4] Prudden and Hodenpyl. N. Y. Med. Jour., 1891, vol. 53.

DISTRIBUTION OF TUBERCULOSIS.

Two careful papers upon the distribution of tuberculosis deserve especial attention. One by Jones,[1] health commissioner of Baltimore, for the year 1898, showed that the largest number of deaths from tuberculosis in Baltimore occur in the more crowded districts, and that the greatest number of victims are negroes. The smaller number of cases in the better portions of the city are, of course, partly accounted for by the fact that the patients of the wealthier class generally seek milder climates and die away from home.

Hinsdale,[2] giving a review of the distribution of tuberculosis in the State of New Jersey, calls attention to the same fact, namely, that the density of population influences the amount of tuberculosis. The more thickly populated places have a higher death rate than those which are situated on the ocean. For the year ended June 30, 1897, the number of deaths from tuberculosis was 3,237, which was 121 fewer than the previous year, or 235 fewer than the average for the ten years from 1887 to 1896.

The report of the Pennsylvania Society for the Prevention of Tuberculosis[3] shows that good work has been done, and that whereas fifteen years ago about 14 per cent of all deaths in Philadelphia were due to that cause there has been a great reduction. This reduction is rightly attributed to an increase in our knowledge concerning the means for the prevention of tuberculosis. This increase in knowledge or an education of the people has been accomplished partly by distributing large numbers of pamphlets, showing how storekeepers, manufacturers, and other employers or laborers can help to prevent the spread of tuberculosis.

Already, in 1889, the board of health of the city of New York recommended the adoption of certain measures designed to limit the spread of tuberculosis. In 1893 the board adopted the recommendations of Dr. Biggs and issued a circular requiring a registration of the names and addresses of all persons suffering from tuberculosis in so far as such information could be obtained, its existence in boarding houses, the importance of positive diagnosis and bacteriological examinations; also requiring the authorities of all public institutions to report the sex, age, occupation, and last address of all tuberculous individuals coming under their care, and prescribing certain regulations in regard to expectoration in public conveyances and upon the streets. The action of the city board was followed by the New York State board of health, and was a good example, inducing other cities and States to pursue a similar course.

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[1] Jones. Rept. Health Commissioner of Baltimore for 1898.

[2] Hinsdale. Phila. Med. Jour., October 22, 1898.

[3] Penna. Soc. for Prevention of Tuberculosis. Phila. Med. Journal, Oct. 9, 1898.

Some interesting points with regard to the distribution of tuberculosis have been brought forward in a paper presented by Dock and Chadbourne[1] upon the study of tuberculosis in country people. Out of 100 cases examined—76 males and 24 females between the ages of 11 years and 67 years—84 cases gave a history of good health before the beginning of the characteristic symptoms of tuberculosis. In 74 cases there was no history whatsoever of tuberculosis in the parents. In 12 cases only the mother had tuberculosis, in 13 cases the father had tuberculosis, and in 1 case both father and mother had tuberculosis; and all the facts brought out in connection with the investigations indicated a contraction of tuberculosis from sputum and other sources of infection, and not an inheritance from the parents.

DIAGNOSIS OF TUBERCULOSIS.

Holmes,[2] in 1896, urged the importance of an early diagnosis of tuberculosis, before the presence of bacilli in the sputum, and based his theory for this early diagnosis upon the opinions held by many that the various forms of leucocytes are mere stages of transitional forms in the life history of the cell. He made a number of examinations of tuberculous and pretuberculous individuals in order to try to determine to what extent the number of young leucocytes and the more advanced leucocytes could be used as an indication of the probability of the presence of tuberculosis. He holds that the growth and development of the leucocytes correspond exactly to the growth and development which take place in the animal body, and that, just as in tuberculosis of the individual or of the animal we find a rupture of the continuity of the inclosing membrane, the skin, or mucous membrane, according to whether we have surgical or pulmonary tuberculosis, so in tuberculosis of the leucocytes an identical process is observed. In other words, the law that brings about the changes in the tuberculous individual brings about the same process at an earlier date in the tuberculous leucocytes. The cell shows all degrees of disintegration and the blood serum is loaded with débris from these disintegrating cells. With marked disintegration of the young cells we can safely predict adult cells of weakened vitality; therefore, with marked disintegration in the leucocytes, we can certainly predict a similar condition of the larger organism. When this condition exists the bacilli find a congenial culture medium in which to lodge and develop with very little resistance on the part of the phagocytes. The author reported the examination of the blood of a number of individuals who were submitted to physical examination by other doctors. He reported that his conclusions, as made from an examination of the blood, corresponded closely with the diagnosis made by physical examination. He noted the characteristics of the tuberculous blood to be a marked deviation from the normal percentage of all varieties of leucocytes, a great decrease in the percentage of small leucocytes, a great increase in the percentage of phagocytes, and usually a marked increase in the percentage of large leucocytes. As the tuberculous condition becomes less marked and the convalescence of the patient increases, the percentage of leucocytes decreases. The diagnosis of tuberculosis from the morphological appearance of the blood rests upon the hypothesis that each individual has a biological prototype in the leucocytes of his own blood.

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[1] Dock and Chadbourne, T. L. Phila. Med. Jour., November 5, 1898.

[2] Holmes, A. M. Med. Rec., September 5, 1896.

Denison[1] applied this method as prescribed by Holmes for detecting improvement in a case of tuberculosis, and concluded that improvement could thus be noted, and, further, that patients that were apparently cured by the use of tuberculin remained in a better condition for a longer time than those upon whom tuberculin had not been used.

Renolds[2] called attention to a method of diagnosing tuberculosis of the kidney by the inoculation of guinea pigs, by which it is possible to determine which kidney is affected. Williams and (independently) Stubbert[3] reported many cases of incipient tuberculosis in which an X-ray examination was of great help. Williams,[4] in 1899, reported the examination of 165 cases with the X-rays. In reviewing these cases he showed that in several instances the diagnosis without the X-rays was found incorrect, and that the X-rays often enable the physician to recognize old or latent areas of tuberculosis. Out of a total of 3,000 cases examined by the X-rays, not a single case of injury or inconvenience was found, and Williams emphasizes the fact that signs may be obtained by the X-rays when the disease is not only limited to one side, but is just beginning on that side, before there are any physical signs or cough. The X-ray examination shows that the disease oftener begins in the right than in the left apex.

BOVINE TUBERCULOSIS.

The much discussed question of the dangers of bovine tuberculosis has received considerable attention in the United States. In 1895, Law,[5] writing upon the methods for the extinction of bovine tuberculosis, emphasized the following points: The danger of infecting other animals can be avoided by killing infected animals; by breeding from insusceptible animals; for in cattle, as in man, there are certain families which show a strong susceptibility to given infection and others that show less susceptibility. It is quite within the power of the State to exclude from breeding purposes the susceptible class.' The difficulties of applying the most effective method for the extinction of tuberculosis must be considered from an economical practical standpoint. In round numbers, the United States owns $1,500,000,000 worth of farm stock, in which are included 16,000,000 milch cows and 20,000,000 head of other cattle. The cows produce yearly 5,209,125,567 gallons of milk, or 300 gallons per head. Of the other cattle, probably 5,000,000 are killed yearly for food, representing 1,000,000 tons of beef. Its use can not be materially restricted without dealing a serious blow at our national prosperity. Certain precautions, however, are within reach and not interfered with by economic considerations. Separation of the animals and feeding them from separate troughs, salting the front of troughs and stalls, and, so far as possible, open-air life for the animals. In cities and suburban stables the infection of the herds may reach anywhere from 6 to 90 per cent, whereas among 2,250,000 fat range cattle tuberculosis did not exceed two one-hundredths of 1 per cent. The proportion of tuberculosis among dairy cattle is greater in our city and suburban dairies than it was years ago when a large proportion of the first cows was killed off by lung plague within three months of their purchase. There is one redeeming feature, however, and that is that the city dairymen do not find it profitable to keep the same cows from year to year, and therefore dispose of them. The precautions which should be adopted are to avoid breeding from the animals when they are too young, not unduly to stimulate the milk secretion, to guard against all conditions of ill health, to exclude from dairy herds old and unthrifty cows, and to allow no tuberculous person to care for the herd. If we could exclude dairy herds from the city and other dense aggregations of humanity, and see to it that consumptive persons were debarred from caring for and mingling with cattle and other susceptible animals elsewhere, we could proceed toward the extinction of tuberculosis with confidence. Parker,[1] in 1894, has emphasized the dangers of bad ventilation, improper light, and the like, and called attention to the fact that the dangers of consumption and its communicability had been taken cognizance of in the first instance in the following order: Michigan in September, 1893; New York in December, 1893; and Massachusetts still later. Already, in 1892, Parker had emphasized and called attention to the use of individual stalls for animals, and the necessity of proper sanitary precautions in order to control the disease.

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[1] Denison, Chas. Med. Rec., 1896, Sept. 5.

[2] Renolds, Edward. Bul. Johns Hopk. Hosp., 1898, Nov.

[3] Williams and Stubbert, J. E. Med. News, 1899, Sept. 10.

[4] Williams, F. H. Med. News, 1899, Sept. 16.

[5] Law, Jas. Med. Rec., 1895, vol. 48, No. 21, Nov.

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[1] Parker. Amer. Vet. Rev., 1894, June.

The use of tuberculin for diagnosing disease in cattle was inaugurated by the Bureau of Animal Industry of the United States early in 1891. By preparing it and distributing it to State officials, giving careful directions as to its use; by making careful studies upon certain herds that were treated with tuberculin in order to demonstrate fully its value, the Bureau was enabled to introduce this valuable reagent in many parts of the United States. Some of the States, especially Massachusetts and New York, began a vigorous crusade against tuberculosis, using tuberculin as a means of diagnosis; but, as in the first instance, they endeavored to require the killing of all animals that reacted and have the State provide indemnity. The method of exterminating the disease in this way proved very expensive and had to be modified to a very considerable extent. Parker,[1] reporting the results in testing cattle in Massachusetts during the year 1895, noted that out of 223,636 cattle in that State, the examination of only 5,394 had cost over $100,000. Several articles were written by Kinnell[2] recommending the use of smaller doses of tuberculin than those commonly adopted, but the author claimed that the smaller doses produced a later reaction than large doses and were not so apt to cause a reaction in incipient cases.

It is scarcely necessary to refer to the many papers which have been written giving results of the testing of cattle with tuberculin. Salmon, Osgood, Lyman, Faust, Law, Bailey, Pearson, Armsby, Stalker, W. B. Niles, Russell, Smith, Schroeder, Rich, Kilbourne, and hosts of others all over the United States have used tuberculin for the purpose of diagnosing disease with satisfactory results. Of the hundreds of thousands of cases that have been tested with tuberculin prepared in the Biochemic Laboratory of the Bureau of Animal Industry, in Washington, reports of which have been received, the diagnosis has been questioned possibly in twenty cases, and in these cases the examinations could not be said to be altogether free from oversight. Occasionally we find records of very strenuous objections being made on the part of the people of different States. In July, 1897, Smith, Ernst, Kinnell, Wood, and Frank S. Billings[3] were called upon to make autopsies upon 130 cattle that had been tested in Lowell, Mass., with tuberculin. The majority of the committee reported the results of the examinations satisfactory, as 129 out of 130 animals tested had reacted and all but 3 were found tuberculous, although a large proportion were but slightly affected. Despite the opposition thus encountered, a number of the States still conduct a crusade against tuberculosis, although the method of dealing with infected animals has been somewhat modified. The Danish method, as recommended by Professor Bang, offers a more economic solution of the problem of the disposal of the animals. In those cases where it has been possible to carry out this method, very satisfactory results have been obtained, so that the milk from diseased animals when sterilized can be often used for feeding calves without danger of the latter becoming infected. The regulations in accordance with which the different States indemnify the farmers for the animals that are killed vary. In some of the States the owners receive full valuation for the cattle which may be killed and found free from disease and half valuation for cattle killed and found diseased. Other States give limited appraised values. New York, New Jersey, New Hampshire, Massachusetts, Vermont, Rhode Island, Pennsylvania, Connecticut, Illinois, Indiana, Ohio, California, and Wisconsin have all carried on a more or less complete inspection of their cattle, and, according to a report of Dr. Pearson[1] for the year 1897, it would appear that there was a slight decrease of bovine tuberculosis in Pennsylvania, basing the estimate upon tests made over a short period of time. To draw positive conclusions from statistics, however, it will be necessary for a larger number of years to be taken into consideration. Nevertheless, in those States where tuberculin has been used and where the educational crusade has been carried on, the farmers have begun to realize and to appreciate the fact that they can not afford to have diseased cattle in their herds.

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[1] Parker. Amer. Vet. Rev., 1895.

[2] Kinnell. Amer. Vet. Rev., 1894, July.

[3] Smith, T. H. Ernst, H. C. Kinnell, G. N. Wood, Chas. R. Billings. Amer. Vet. Rev., 1897, July 26.

Opponents to every new method of treatment or enforcement of hygienic regulations are always to be found, and there were many who claimed that tuberculin might injure healthy cows. To obtain some idea in regard to this matter, de Schweinitz,[2] in 1894, carried on some experiments upon cows, giving them large doses of tuberculin and testing the milk both before and after injections. Complete careful analyses of the milk were made in both cases, extending over a series of days, but no appreciable change in any of the constituents of the milk could be noted. Law,[3] in 1895, reported experiments on a similar line with tuberculin upon healthy cows. His results confirmed the previous reports of de Schweinitz, namely, that the tuberculin had no appreciable influence either on the healthy animal or on the character of its products used by man for food.

THE RELATION OF BOVINE TUBERCULOSIS TO HUMAN TUBERCULOSIS.

The relation of tuberculosis in animals to tuberculosis in man has received considerable attention. In 1895 Rich[4] reported five cases of tuberculosis in man where the disease could be undoubtedly traced to the use of milk from tuberculous animals. In 1897 Bailey[1] reviewed the work in this line, and called attention to the fact that Williams of Massachusetts, Hallock of South Carolina, and Stalker of the Iowa board of health, all reported cases of tuberculosis in children of non-tuberculous parents, in which the tuberculosis could be undoubtedly traced to milk infection. In the same year, West[2] reported that two children of Luther Bridges had recently died from tuberculosis, which was due to drinking the milk from a cow which, upon being killed, was found to be the subject of extensive tubercular disease, largely localized in the udder. Five of Bridges's nine children were at the time suffering from tuberculosis and several of them very ill. Von Ruck[3] reports the case of a farmer undoubtedly infected by milk from a tuberculous animal. His case was for six weeks mistaken for typhoid fever. Shortly after his death intestinal tuberculosis was found in one of his children that was taking the milk from a cow with a tubercular udder. The father had used this milk in quantity even during his illness. The child had been removed when the father was taken sick and was probably not infected from the father. It died from tubercular meningitis. In 1894, Smith[4] reported a very careful study of the autopsy of a tuberculous herd owned by the Soldiers' Home near Washington, D. C., which had been tested by the inspectors of the Bureau and upon which careful autopsies had been made. This was one of the herds which had served for an experimental study in determining the value of tuberculin. Smith noted very carefully the location of the tuberculous lesions and the probable source of infection, and concluded that the infection of the mesenteric glands showed that the tubercle bacilli must have obtained access to the body by way of the digestive tract and escaped destruction by the digestive processes, and perhaps at the same time the animal may have inhaled bacilli, and a second series of infection been started. In 1898 Smith[5] reported a careful comparative study of the bovine tubercle bacilli and the human bacilli from sputum. The author made careful morphological studies of the bacilli taken from human sputum and of various bovine bacilli, and noted differences in the virulence of the disease from the various germs, the lesions which were produced upon experimental animals and the like, and brought out many other points which would indicate the possibility of a great many varieties of bacilli, and suggested many possible important lines of investigation in the study of the bacilli from various sources, both animal and human. Trudeau and de Schweinitz had called attention to the fact that the environment and food of the germ in different animal bodies might influence its appearance and pathogenic properties very materially. This point has been emphasized by them, in papers referred to above, and others in calling attention to the rapid decrease of virulence in tubercle bacilli when grown outside of the animal body upon various artificial media. In an earlier paper, in 1896, Smith called attention to the differences in the morphological appearances of tubercle bacilli obtained from sputum and from a cat, which seem to the writer to be readily accounted for by the change in the nutritive media upon which the germs developed either inside or outside of the animal body. As some animals are more susceptible to tuberculosis than others, and as practically almost all animals can be infected with tuberculosis, it would seem that there must be a possibility of more or less virulent or attenuated varieties of tubercle bacilli being established, just exactly as a plant, the habitat of which is in a warm climate, can, by careful selection and cultivation, be gradually accustomed to more severe surroundings. Whether we accept, however, the idea that tuberculosis is communicated from cattle to man very readily or with difficulty, the fact remains that this disease amongst cattle is the cause of many dangers which should be avoided. Not only is it necessary to destroy tuberculous animals that are the source of infection for others, but it is also necessary to disinfect the stables thoroughly before they are used for housing healthy animals and absolutely to prohibit the attendance of tuberculous individuals upon healthy cattle.

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[1] Pearson. Phila. Med. Journ., 1898, Sept. 24.

[2] De Schweinitz. Bul. Bureau of An. Ind., Dept. of Agr., 1894.

[3] Law, Jas. Amer. Vet. Rev., 1895.

[4] Rich, F. A. Vet. Mag., 1895, Nov.

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[1] Bailey, G. H. Amer. Vet. Rev., 1897, April.

[2] West, W. L. Journ. Amer. Med. Assoc., 1897, June 19.

[3] Von Ruck. Journ. of Tuberculosis, 1899.

[4] Smith. Bul. Bureau of An. Ind., No. 7.

[5] Smith. Journ. Exper. Medicine, 1898.

TREATMENT OF TUBERCULOSIS.

The treatment of tuberculosis in man, it is now pretty generally conceded, can in most cases be best accomplished in sanatoriums or in localities where the patients can be controlled and induced to lead an outdoor life. There are in the United States 35 sanatoriums, camps, and hospitals for tuberculous individuals, and in Canada two.[1] All of

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[1] UNITED STATES.

Hygeia (not sanitarium), Citronelle, Ala.
Convict Camp, Alabama.
The Home (no physician), Denver, Colo.
Glockner Sanitarium, Colorado Springs, Colo.
The Colorado Sanatorium (founded 1896; dry altitude, 5,500), Boulder, Colo.
Chicago Sanitarium for Tuberculosis, Chicago, Ill.
Cook County Hospital for Consumptives, Dunning, Ill. (1898).
Hospital for Consumption, Baltimore, Md.
Sharon Sanitarium for Pulmonary Diseases, Sharon, Mass.
Consumptives' Home, Roxbury, Mass.
Free Home for Consumptives, Dorchester, Mass.
Massachusetts State Hospital for Consumptives, Rutland, Worcester County (1895; opened 1898).
Sanatorium, Chicao Springs, N. Mex.
Latta Sanatorium, East Las Vegas, N. Mex.
Ladies' Home Sanatorium, East Las Vegas, N. Mex.

[Note continued on p. 273.]

these, with the exception of two, are private institutions, supported by private subscriptions and pay patients. One of the first established in the United States was in the year 1882 in New York City; later, in 1884, one was started in the Adirondacks (Saranac Lake), while the first hospital for the treatment of the consumptive poor, near a large city without any consideration of special climatic conditions, was inaugurated at Sharon, near Boston, in 1891. The sanatorium at Saranac, which was established through the enthusiastic work of Dr. Trudeau, and one at Liberty, in charge of Dr. Stubbert, erected in memory of Dr. Loomis, are institutions which deserve special mention. Altitude, climate, with plenty of sunlight in connection with the establishment of sanatoriums, have always been fertile subjects for discussion.

In 1898 Mitchell and Crouch[1] presented a paper upon the immunity of people in high altitudes from tuberculosis, and called attention to the fact that there are two conditions which militate against the spread of tuberculosis in high altitudes. They think that the solar rays acting through the somewhat thinner atmosphere more rapidly destroy the virulence of exposed tuberculous matter, and that, in addition, the individual vital functions are so operated upon by the varied meteorological phenomena that they are specially fortified against the invasion of the tubercle bacilli.

[Note continued from p. 272.]

St. Anthony's Sanatorium, near East Las Vegas, N. Mex.
Adirondack Cottage Sanitarium, Saranac Lake, N. Y.
Loomis Sanitarium for Consumptives, Liberty, N. Y. (1896),
Loomis Hospital for Consumptives, New York City, N. Y.
Seaton Hospital for Consumptives, Spuyten Duyvil, New York.
Sanitarium Gabriels, Paul Smiths, N. Y.
Hill Crest, Santa Clara, Franklin County, N. Y.
Brooklyn Home for Consumptives, Brooklyn, N. Y.
St. Joseph's Hospital, New York City, N. Y. (founded 1882).
Montefiore Country Sanitarium, Bedford, N. Y. (founded September, 1897).
Winyah Sanitarium, Asheville, N. C. (1888).
Asheville Sanitarium, Asheville, N. C.
Hospital for Diseases of the Lungs, 411 Spruce street, Philadelphia, Pa.
Rush Hospital for Consumptives, Philadelphia, Pa.
White-Gables Southwest Texas Sanitarium, Boerne, Kendall County, Tex
Pennsylvania Sanatorium, White Haven, Pa.
Chicago Hospital for Consumptives, Chicago, Ill.
United States Government Sanatorium, Fort Stanton, Lincoln County, N. Mex.
Hospital for Diseases of the Lungs, Chestnut Hill, Pa.
United States Marine-Hospital Sanitarium, Fort Bayard, N. Mex.

CANADA.

Muskoka Cottage Sanatorium, Gravenhurst, Ontario, Canada (September, 1897).
Laurentian Sanatorium, St. Agathe des Monts, Ontario, Canada (August, 1899).

[1] Mitchell and Crouch. Bost. Med. and Surg. Journ., 1898, July 28.

As has been ably pointed out by Barton,[1] the method of treatment of tuberculous cases which should be used in connection with sanatorium treatment are such as take into consideration first of all the character of the case—whether it is one of simple tuberculosis or whether it is quiescent or progressive, whether the conditions of cure are absent or present, and whether the patient has the vitality or recuperative power to respond to treatment. As just noted, the best hygienic conditions and proper outdoor life are of more importance than a change of climate. The time required to cure tuberculosis is long (which must always be taken into consideration in the method of treatment), and the treatment must be continued, not only until the tubercle bacilli have disappeared from the sputum, but until the general condition and nutrition of the patients have been restored. Hygienic, mechanic, topical, and medicinal treatment all combined are the best for those who suffer with tuberculosis. While we can not, perhaps, hope to secure a specific cure for tuberculosis, we can make use of various means that will aid in the natural curative processes under proper hygienic and climatic surroundings.

Knopf, Myer, and Pryor[2] have all written articles emphasizing strongly the importance and necessity of the State taking control of tuberculosis, and Goler,[3] reviewing the number of deaths from consumption in New York State for a period of nine years, brings out some very interesting statistics in the same connection. He points out that while there are 22,000 insane in New York State, of which at best 12 per cent are curable, and 13,000 epileptics, of which an unknown number die, the consumptives number approximately 50,000, of which at least 22 per cent are curable and 25 per cent are allowed to die. For the insane and the epileptic the State of New York expends about $7,000,000 a year, while no money is provided for the cure of the consumptives.

As adjuncts to the sanatorium treatment of tuberculosis, the methods which have received the most careful attention are the use of tuberculin of various sorts and the use of serums for tuberculosis which might be supposed to have curative properties.

In 1892 Trudeau[4] reported experiments upon the treatment of tuberculosis in rabbits' eyes with Koch's tuberculin which did not cure experimental tuberculosis in guinea pigs, although its specific influence on the primary lesions was indisputable. Hunter's modification of tuberculin apparently contains, according to Trudeau, less of the remedial principle than tuberculin and was apparently quite as dangerous. He reported that experimental tuberculosis in rabbits could be cured by injections of filtered culture medium from tubercle cultures, but that the permanency of such a cure had not been established. Trudeau also reported the results of his experiments in treating patients with tuberculin or Hunter's modification of tuberculin. He concluded that the curative action, if any, with tuberculin was often uncertain and recommended the use of tuberculin as a means of diagnosis in doubtful cases. Eichberg,[1] Thorner,[2] and Ravogli[3] reported a number of cases in which the old tuberculin had been used for treatment with inconclusive results. Denison[4] reported a few cases treated with tuberculin with satisfactory results.

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[1] Barton, J. L. Med. Rec., vol. 52, No. 11.

[2] Knopf, Myer, Pryor. Med. Rec., 1900, Jan. 27; Med. Rec., 1899, Oct. 28; Med. News, 1899, Feb. 18.

[3] Goler, G. W. Med. Rec., 1899, Nov. 18.

[4] Trudeau, E. L. Med. News, 1892, Sept. 3.

Fisch[5] reports the experiments which he had made in endeavoring to produce an antitoxic serum for treating tuberculosis, by injecting horses with TR.[6] He claims that in this way he has produced a serum which has both antitoxic and bactericidal properties, for which he proposed the name of antiphthisic serum. Freudenthal[7] reports satisfactory results with the use of a serum from Fisch's laboratory in treating tuberculosis. In 1898, Edson[8] recommended the treatment of tuberculosis with pilocarpin and phenole. Sutherland,[9] in 1899, recommends the treatment of tuberculosis with the watery extract of tubercle bacilli. Rochester[10] suggests the use of oxalate of cerium as a medicine for tuberculosis. Pepper,[11] in 1895, reported a case in which the results were very satisfactory after the treatment with strychnine and atropine; and Baldwin,[12] in 1895, reported the effect of peppermint inhalation on tuberculosis, and, while he noted a diminution or retardation of growth caused by the peppermint oil upon the germs in test tubes, he did not note the same effect in the animal body.

In 1898, Murphy[13] recommended the use of nitrogen for compression of the lung in tuberculosis. Vaughan[14] reported results of cases treated with nucleinic acid, and Ingalls[15] emphasized the importance of systematic physical training in the prevention and cure of tuberculosis. Other doctors reported cases of tuberculosis which were treated with apparently satisfactory results with a serum which bore the stamp of commercialism too markedly for the results to be considered of scientific value or conclusive. The use of lactic acid, combined with surgical treatment, was recommended by Levy.[1] Mitchell,[2] in emphasizing the importance of sunlight on the influence of cases of tuberculosis, records some experiments in which he had tested the influence of sunlight on tuberculous sputum in Denver, Colo. He concluded that on the sandy soil of Denver, the tubercle bacilli as expectorated, after being exposed to the direct rays of the sun for thirty-five hours, were still virulent. There was little appreciable diminution of virulence after twenty hours but, after the exposure of a longer period than thirty-five hours, the virulence of the bacilli was gradually diminished.

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[1] Eichberg. Med. News, 1893, Jan. 28.

[2] Thorner, Max. Med. News, 1893, Jan. 28.

[3] Ravogli, A. Va. Med. Semimonthly, 1897, Dec.

[4] Denison, Chas. N. Y. Med. Journ., 1895, Aug. 3.

[5] Fisch, Carl. Journ. Am. Med. Assoc., 1897, Oct. 30.

[6] New Koch tuberculin.

[7] Freudenthal, W. Med. News, 1899, Feb. 18.

[8] Edson, Cyrus. Med. Rec., 1898, Feb. 8.

[9] Sutherland, J. Journ. of Tuberculosis, 1899, Oct.

[10] Rochester, Delancey. Med. News, 1899, Feb. 25.

[11] Pepper, Wm. Univ. Med. Mag., 1895.

[12] Baldwin, E. R. N. Y. Med. Journ., 1895, May.

[13] Murphy. Journ. Am. Med. Assoc., 1898.

[14] Vaughan, Victor. Med. News, 1897, Mar. 20 and 27.

[15] Ingalls, E. F. Trans. Am. Climat. Assoc., 1898.

Hirschfelder,[3] in 1897, recommended the use of what he called *oxytuberculin* for the treatment of tuberculosis, but the results obtained by others with this material were not satisfactory.

Weed,[4] in 1897, also recommended the treatment of laryngeal tuberculosis with lactic acid.

De Schweinitz[5] reported experiments in preparing a serum for the treatment of tuberculosis by injecting animals—horses, cows, etc.—with an extract made from attenuated cultures. These attenuated cultures were the same as those referred to earlier in this paper, by the use of which it was possible to produce artificial immunity from tuberculosis in guinea pigs. The theory upon which the author worked was that, if these attenuated cultures produce immunity in small animals, they would be the most satisfactory material for use in larger ones, and the serum obtained from large animals treated with such attenuated cultures should prove valuable. He reported experiments upon small animals which demonstrated the prolongation of life of the guinea pigs by the use of serum so prepared. He also reported some cases in sanatoriums in which the doctors had used the serum with apparent beneficial results. In this same article Dorset and de Schweinitz described the isolation of a necrotizing acid which they obtained from tuberculous cultures and which they considered as responsible for necrosis and the secondary pneumonia so often noted in tuberculosis. They also called attention to the fact that the cell of the tuberculosis germ contains a very thick envelope of fatty material, which fact accounts, in part, for the difficulty of destroying the tuberculosis germ, and also accounts for the difficulty of extracting from the tuberculosis cultures all the substances that are produced by the growth of the germ. They claim that the use of an extract from the tubercle bacilli freed from this fatty matter for the purpose of injecting animals that are to yield an antitoxic serum, or the use of such an extract for treating animals directly, should give satisfactory results.

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[1] Levy, Robt. N. Y. Med. Journ., 1895, July 20.

[2] Mitchell, W. C. Journ. Pathol. and Bact., 1899, May.

[3] Hirschfelder. N. Y. Med. Journ., 1897, Oct. 16.

[4] Weed, Chas. R. N. Y. Med. Journ., 1897, Jan. 9.

[5] De Schweinitz, E. A. N. Y. Med. Journ., 1893, Mar. 11.

Baldwin and Trudeau[1] report experiments which they made in the study of tubercle bacilli and their various efforts to produce an antitoxic serum. They used for this latter purpose sheep, fowls, donkeys, and rabbits, and their work dated back to 1894. They treated these animals with various extracts of tubercle bacilli, with and without preservatives, tuberculin mixed with serum, and so on. Their conclusions were that they could not obtain any satisfactory serum from sheep, from chickens, or from donkeys, but that rabbits which had been inoculated with virulent and nonvirulent tubercle bacilli produced a serum which apparently conferred some protection.

A study of the composition of the tubercle bacilli, the presence in them of a nucleo-proteid, the separation of the fever-producing principle, the content of fatty matter of the bacilli, the composition of the mineral matter which they contain, and the character of the fatty acids which can be obtained by saponification of the fatty matter of the germs, already studied by de Schweinitz and Dorset,[2] was carried on and published in the American and German journals more than a year before some similar investigations were reported from other countries. Levene[3] described a proteid which he had isolated from the bacilli of tuberculosis.

The important bearing of these factors upon the progress of tuberculosis was strongly emphasized by de Schweinitz in 1897 and 1898, and a still more thorough study in a similar line of the bacilli from various sources, both human and animal, is at the present in progress.

The use of TR as a substitute for old tuberculin again aroused renewed interest, after the failure of the old tuberculin in the treatment of tuberculosis, but the treatment with TR was not found to give very much more satisfactory results than were obtained with the original tuberculin. In addition, Trudeau[4] was the first to call attention to the fact that the TR might contain live virulent tubercle bacilli, and consequently in this condition was not adapted for use. Fisch[5] used TR for the purpose of injecting horses in order to immunize them and obtain serum. He reports that this serum has given satisfactory results, and also that a serum may be obtained from grease which may prove useful in treating tuberculosis. The serum prepared by de Schweinitz, before referred to, has been used quite extensively in the Loomis Sanitarium at Liberty, N. Y., under the direction of Dr. J. E.

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[1] Baldwin and Trudeau, E. L. Am. Journ. Med. Sci., 1898, Dec.

[2] De Schweinitz and Dorset. N. Y. Med. Journ., 1898, May 14.

[3] Levene. Med. Rec., 1898, 54, No. 25.

[4] Trudeau, E. L. Med. Rec., 1897, Oct. 30.

[5] Fisch. Journ. Amer. Med. Assoc., 1899, Apr. 8.

Stubbert, the physician in charge, and Dr. Stubbert's[1] reports contain very encouraging results obtained with this serum. Not only were the patients benefited and a fair percentage cured, but examination of the cured ones after two years showed that the patients remained well and retained strength after returning to their former surroundings, while cases apparently cured in other ways relapsed. In other words, it would appear that where the patients are treated with a scientifically prepared serum a more definite immunity is established than could be secured in any other way. While the serum treatment can not be recommended as a specific, it would seem that it can be recommended as a valuable aid to dietetic and hygienic treatment; it exerts apparently a beneficial effect and reinforces the natural immunity. If by the use of serum certain of the dangerous products of the tuberculosis germ can be neutralized, as, for example, the necrotic acid to which we referred (and this necrotic acid is undoubtedly responsible for the destruction of tissue in incipient cases of tuberculosis, and may be considered a weapon by means of which the germ protects itself from the attack of the surrounding leucocytes), then a great step in advance has been made and the future offers much hope. Chopin[2] experimented with normal horse serum for curing experimental tuberculosis in guinea pigs with negative results. Hewetson[3] reported the treatment of tuberculous guinea pigs with a serum prepared by Paquin with negative results. While tuberculin did not give the results which were enthusiastically expected by the many, although not claimed by the originator, the discovery of tuberculin had stimulated the study and research in connection with all tuberculosis problems to such a very great extent that the advances due directly to the discovery of tuberculin are incalculable. As a means of diagnosis, both in cattle and in men, it is excellent and may be called specific. Various authors have claimed reactions similar to that given by tuberculin upon injecting subjects with albumose or similar products, but Cabot,[4] who tried the effect of some normal salts and somatose as a substitute for tuberculin, obtained only negative results.

The number of deaths from tuberculosis in man in the United States in the year 1880 was 91,551; in 1890 the number of deaths was 101,903. The deaths from tuberculosis in Ontario, as reported by Bryce, were proportionately slightly less than that in the United States, the percentage of all deaths in the United States from tuberculosis being about 12 per cent, while in Ontario for the same time it was about 11.3. This, however, would naturally be expected, as the population in the United States is more dense. The importance and necessity of the sanatorium treatment, or, to put it in other words, of the fresh-air and outdoor treatment of tuberculosis—for this is really what the sanatorium treatment means, the patients being so situated that they can be induced to obey certain regulations—is growing continually in the United States.

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[1] Stubbert, J. E. N. Y. Med. Journ., 1898, July 30; Med. News, 1899, Mar. 11.

[2] Chopin, Dwight H. Med. Rec., vol. 48, No. 21.

[3] Hewetson, S. W. N. Y. Med. Journ., 1895, Nov. 9.

[4] Cabot, R. C. N. Y. Med. Journ., 1899, Feb. 25.

A little over a year ago the Marine-Hospital Service of the United States established a sanatorium for the treatment of the sick of the service; and a sanatorium at Fort Bayard, N. Mex., for the treatment of officers and enlisted men of the United States Army was also established. A report of this latter sanatorium was given by Dr. Ballack,[1] who was in charge in 1889. Bowditch[2] reports upon the results obtained at the Sharon sanatorium.

The principal sanatoriums and hospitals for the treatment of tuberculosis in the United States, or resorts for the tuberculous referred to before, compiled and amended from Knopf's table, are given below.

Sometime ago I sent a circular letter to these different institutions for the purpose of securing details as to the different methods used for the treatment of tuberculosis and the results obtained by the different methods. From the answers received from nine of these sanatoriums in America and two in Canada, I have compiled the following points of interest: In these eleven sanatoriums there have been admitted since their foundation about 8,000 tuberculous patients. One of these sanatoriums was started in 1882, one in 1884, one in 1888, one in 1891, one in 1895, two in 1896, two in 1897, one in 1898, and one in 1899. About 700 of the patients have been discharged as cured, about 1,800 as improved, and about 1,000 were reported as having died at the sanatoriums. These deaths, however, include a large number of cases from one hospital to which cases were never admitted until they were very far advanced. The number of deaths, of course, does not include those who were in such bad condition that they left the sanatoriums or hospitals for their homes. At seven of these sanatoriums tuberculin was used for testing doubtful cases; in two, for the purpose of testing supposedly cured cases. Two of the sanatoriums had used antituberculosis serum as prepared in the Biochemic Laboratory of the United States Department of Agriculture at Washington—one of the sanatoriums with very satisfactory results; the other, where the serum was used on a smaller number of cases, with inconclusive results. Two of the sanatoriums used tuberculin, one with bad results, the other with results that show apparently slight improvement. Two of the sanatoriums used serum from various sources, different from the one above referred to, with entirely negative results, and two of the sanatoriums used a watery extract of the tubercle bacilli with negative results. Five of the sanatoriums reported that their patients did a great deal better when treated in addition to hygienic and dietetic surroundings, while six other sanatoriums claimed to obtain just as good results with no form of medication. One sanatorium, located in a climate considered bad for tuberculous patients, claims that the results obtained are excellent and that climate is of but little importance. The materials used for treatment were creosote, ichthyol, tuberculin, aids to digestion, strychnine, guaiacum, watery extract of tubercle bacilli, and serums of various sorts. Of these serums, the one that seemed to give the most satisfactory results was the material first referred to. Where the sputum of the cases was examined when the patients entered the hospital an average of 90 per cent showed the presence of bacilli, while the bacilli, it is claimed, was found in from 48 to 83 per cent of those who left the hospital.

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[1] Ballack, A. S. Med. News, 1899, Dec. 23.

[2] Bowditch, B. Y. Med. News, 1899, Oct. 7.

Four sanatoriums reported that while they could not trace the disease directly to infection from milk there were many suspicious cases and some evidence of indirect infection. In only one of the sanatoriums pasteurized or sterilized milk was used for the patients. In one other sanatorium the use of pasteurized milk was begun in 1900. In several others the milk was used only from carefully tested herds, while in the remainder but little attention was paid to the character of the animals from which the milk was obtained. It will be interesting to compare in the future for a series of years the differences in the results obtained in those sanatoriums where pasteurized milk is used and in those where very little attention is paid to the source of this supply.

The review herewith given includes the greater proportion of the researches that have been made in connection with tuberculosis from an experimental standpoint. It does not include the many valuable reports of many separate individuals upon their results with the use of tuberculin as a means of diagnosis in men and animals, as these results were simply confirmatory of work that had been done by others, but still very valuable for record. Nor does this review include a mention of the special unusual cases of tuberculosis, surgical or otherwise, that have been noted by various authors, nor mention of the cases of tuberculosis that are sometimes found in animals usually considered almost insusceptible to this disease. It has been prepared and presented for the purpose of emphasizing the fact that the study of tuberculosis in the United States is not in the background; that many men are devoting their time to these investigations; and that their results deserve very careful consideration.

INFORMATION CONCERNING THE ANGORA GOAT.[1]

George Fayette Thompson,
Editorial Clerk, Bureau of Animal Industry.

PRELIMINARY REMARKS.

The goat has accompanied civilization into all parts of our country—not numerously, but persistently. He is everywhere, and is well known. There are very few people who have not seen a goat, and there are fewer still, no doubt, who have seen many goats. The comic writers, playing upon his peculiar habits, have brought him into disrepute, although these habits, to a large extent, are such as are recommending him for special favor at this time. His fame is as a denizen of vacant lots and back alleys, subsisting upon anything or nothing, and a foe to everything. So far as the general public is concerned, he has not been reckoned with as a useful animal and has been tolerated only as a pet for children.

During more recent years a great interest has been awakened in the goat, and it now seems that he is about to receive the consideration that is due him. One of the causes contributing to this awakening was an article in the Yearbook of this Department for 1898, entitled "Keeping goats for profit," by Capt. Almont Barnes, of the Division of Statistics of this Department. The information which this article contained was widely disseminated. The Yearbook was distributed to the extent of half a million copies, and, besides, in order to meet the growing demand, the article was reprinted separately and mailed to many thousands of inquirers at the Department for information on the subject of goats; and not alone the agricultural papers, but the daily press as well, took up the matter and exploited the good points of the goat industry. The article set forth, among other things, the great value of the goatskins which we import annually, and how we ourselves might easily produce them; the usefulness of the carcass for food, especially of the Angora breed; the exceedingly small expense involved in raising the animal, owing to his habits of feeding upon that vegetation which is in greatest abundance and which other ruminants refuse; the million of acres of land in the United States that might be made available for goat raising which otherwise would remain, as heretofore, unemployed.

The result of this wide distribution soon developed the fact that the goat was present in the United States in larger numbers than was supposed. This is especially true of the Angora breed; in fact, the number of common goats in the United States is less than 50,000. Although very little has been said or written about Angora goats during the last forty years, they have been extensively bred in the Western States and Territories, especially in Texas, New Mexico, Nevada, Florida, California, and Oregon. In a general sense, all those animals which are a cross in any degree of the Angora goat are considered as Angoras, for the Angora and the common goat readily cross, and the latter frequently becomes the foundation stock of a good flock of fleece-bearing animals.

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[1] Also published as Bulletin No. 27 of this Bureau.

It is the purpose of this article to deal with the Angora goat only, and the effort is made to answer such questions as have been received by the Bureau from all parts of the country. These answers are based upon the experiences of those who have raised them, some of whom have been in the business forty years and more. Differences of opinion are found to exist on several important points, where each contestant appears to occupy plausible premises; but this is not at all strange when the history of the Angora goat is considered, for it is not certain that all of the animals imported as purebreds were pure; indeed, it is held by some of our leading breeders that there is no longer in Turkey or elsewhere any such thing as a purebred Angora goat. Besides, there has been no general register for Angora stock in the United States until within a year or two, and each breeder has been at liberty to judge points for himself. If a general Angora register had been established thirty or forty years ago, the industry would now be conducted upon somewhat definite lines, and most of the questions now arising as to points in breeding would have been settled. In this connection it should be stated that C. P. Bailey & Sons Company, of San Jose, Cal., have kept a private register of their goats since 1867, but there appears to be no other similar record.

ORIGIN AND HISTORY.

The purpose of this paper is to give prominence to those phases of the Angora goat industry that are of practical importance; therefore a brief space only will be devoted to the history of the breed.

Naturalists generally agree that there are about ten species of wild goats, all confined to Europe and the Himalayas of Asia. These are divided into two groups, as follows:

I. *The ibexes.*—These, according to Hayes, have, as a distinctive characteristic, horns "flat in front, with a horizontal triangular section, furnished with large transversal knots."

II. *Goats proper.*—These, according to Hayes, have horns "compressed and carinated in front," and, according to Wood, "may be distinguished from the ibex and the sheep by the peculiar formation of the horns, which are compressed and rounded behind and furnished with a well-developed keel in front."

The second group is subdivided into two subspecies—*Capra falconeri* and *Capra œgagrus.* The latter is also known as the Paseng, the Bezoar goat, or wild goat of Persia, and is generally accepted as the goat from which the Angora is descended through *Capra hircus*, which is claimed to be the origin of all the common breeds of goats.

As to the parent of the Angora stock, there is a difference of opinion between the two best-known writers on the subject—John L. Hayes, author of The Angora Goat, etc. (1882), and S. C. Cronwright Schreiner, author of The Angora Goat (1898). The one takes the position that it is descended from *Capra falconeri*, the other from *Capra œgagrus.* Owing to the additional information which has been obtained since the appearance of Hayes's book and which is embodied in Schreiner's work, there can hardly remain a doubt of the correctness of the contention that the Angora goat descended from *Capra œgagrus.*

Schreiner, who has made extensive research, has described these two subspecies as follows:

> *Capra falconeri* has a beard which extends from the chin to the shoulders and chest, and long spirally twisted horns, the twist being outward from the base. The males, when old, become whitish all over. The ewes have a beard confined to the chin, and small horns with a slight spiral twist. It is a native of the Western Himalayas, northern Afghanistan, and possibly of Persia; it is also found generally in Cashmere and on the Tibetan side of the Himalayas. Fossil remains show that it is one of the oldest types of goats.
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> *Capra ægagrus*[1] is chiefly remarkable for its enormous horns, which are larger proportionally than in any other ruminant animal; they approximate the triangular in form, transversely rigid, and are bent backward as in the domestic varieties, being scimitar-like in shape of curve, and having no spiral twist. Large horns of *Capra ægagrus* measure 40 inches along the curve, but a length of upward of 52½ inches, with a basal girth of 7 inches, has been recorded. It stands somewhat higher than any of the domesticated varieties of the goat (an adult male stood 37 inches at the withers), from which it further differs in its short and powerful neck, its stouter limbs, and slender body. In the female the horns are exceedingly diminutive or are altogether wanting. The fur, which over the greater part of the body is short, is of a grayish brown color, with a black line running along the entire length of the back, while the under surface of the neck and the beard, which is present in both sexes, are of a brown color. In the winter coat the hair on the neck and shoulders is rather longer than elsewhere, and in the same season, in the colder part of the animal's habitat, a coat of woolly fur is developed beneath the hair.

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[1] There is evidence that in classic times this goat was widely distributed over the Grecian Archipelago, although in Europe it is now found only in Crete, the island of Antemelo, in the Cyclades, and perhaps also in Guire to the northeast of Eubœa. Eastward it is found in the hills and mountains of Asia Minor, being especially common in the Taurus range, and it extends thence through Persia into Baluchistan, Sind, and Afghanistan. In India its range does not extend beyond the western side of Sind. It is found in Sind and Baluchistan in hills a little above the sea level; in the mountains of Persia it ascends to an elevation of 11,000 feet to 12,000 feet.—*Schreiner.*

The Angora breed of goats originated in the vilayet of Angora, in Asia Minor, but it is not known when this was. Some have ventured to say that it was 2,400 years ago. There is pretty strong evidence which goes to show that they were a distinctive breed when Moses was leading the Israelites out of Egypt. Goats' hair was spun by the Israelites for curtains and other purposes for use in the temple.[1] In the story recorded in I Samuel (chapter 19) of the artifice of Michal in deceiving the messengers of Saul by placing an image in the bed in place of David and giving it a pillow of goats' hair, is believed by Pennant to refer to a pillow made of the Angora fleece.

The city Angora, or Enguri, the capital city of the vilayet of Angora, is the ancient Ancyra, and is located about 220 miles south by southeast from Constantinople. Angora was the seat of one of the earliest Christian churches, and was probably established by the Apostle Paul. The province is mountainous to a considerable extent and furrowed by deep valleys. It is about 2,900 feet above the level of the sea. Of the climate Mr. H. A. Cumberbatch, British consul at Angora (1895), and quoted by Schreiner, says:

> The climate is extreme. In the months of January and February the thermometer will mark a minimum of 10° F. for several days at a time, reach as far as 0° F., whilst in June and July the maximum readings of 85° F. are maintained day after day, with little or no rain. The country is covered with snow in the winter, rain and snow falling frequently. In 1894 the total rainfall at Angora was 8.12 inches, but that was an exceptionally dry season. For the first six months of 1895 the rainfall was 10.10 inches, which is somewhat above the average; the heaviest rainfall in twenty-four hours having been 1.20 inches.

It was here that this famous goat reached its perfection—and such a state of perfection as has not yet been reached by the goats of either the Cape of Good Hope or the United States. That the altitude, the soil, or the climate, or all of them together, had much influence in producing this fleece-bearing goat is supported by strong evidence. Dr. John Bachman and the Encyclopædia Britannica both state that the fineness of the hair of the Angora goat may perhaps be ascribed to some peculiarity in the atmosphere, "for it is remarkable that the cats, dogs, sheep, and other animals of the country are to a certain extent affected in the same way as the goats." The same opinion was expressed by Captain Conolly, quoted by Southey (1848): "It is remarkable that wherever these goats exist the cats and greyhounds have long silky hair also—the cats all over their bodies, the greyhounds chiefly on their ears and tails." These statements lead Schreiner to the conclusion that the atmosphere is the chief factor. He says: "At any rate, there seems to be no doubt that a limited and comparatively well-defined region around the town of Angora possesses in a degree unapproached elsewhere in Asia Minor, and probably in the world, those conditions favorable to the development of the soft, silky, lustrous white mohair goat." Too much credit must not be given to the atmosphere of Angora in the production of mohair. That it has a marked influence on animals anywhere is generally accepted. The experience of the Angora breeders of the Cape of Good Hope and the United States shows that, with the best animals, a fleece equal to any produced by Turkey may be obtained. There are other and stronger reasons why the mohair of these two countries is not equal to that of Angora province, chief among which is the adulteration of the blood. Besides, the breeders of this country have learned that the feed of the animal has a telling influence on the quality of the mohair in the same way that it has a pronounced effect upon the meat.

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[1] Take ye from among you an offering unto the Lord: whosoever is of a willing heart, let him bring it, an offering of the Lord; gold, and silver, and brass, and blue, and purple, and scarlet, and fine linen, and goats' hair.—Exodus xxxv, 5, 6.

And every man, with whom was found blue, and purple, and scarlet, and fine linen, and goats' hair, and red skins of rams, and badgers' skins, brought them.—Exodus xxxv, 23.

And all the women whose heart stirred them up in wisdom spun goats' hair.—Exodus xxxv, 26.

And he made curtains of goats' hair for the tent over the tabernacle: eleven curtains he made them. The length of one curtain was thirty cubits, and four cubits was the breadth of one curtain: the eleven curtains were of one size.—Exodus xxxvi, 14, 15.

Mr. Henry O. Binns, who had about twenty years of experience with these goats in the vilayet of Angora, says the pure animals were about bred out in 1863. The reason for this was the extensive crossing with the common Kurd goat, reference to which has already been made. As early as 1839 there ceased to be a demand for the spun yarn of Asia Minor, owing to the fact that Europe could spin the yarn at much less cost; but there was a European demand for the raw hair which exceeded the supply. This condition of things led to complications and a mixture of breeds from which the mohair world has not yet recovered. There can hardly remain a doubt, however, that, with the recent renewed interest in the industry, and with the intelligence that the breeders will bring to bear, the Angora goat industry will soon be placed on the highest plane.

THEIR HISTORY IN THE UNITED STATES.

The history of the Angora goat in the United States has been marred by the carelessness or indifference of occasional writers for the press who have been often inaccurate as to dates or facts, and also by others whose interests have doubtless led them into exaggerations. The real facts of its history in the United States, however, are so few and so simple as to prompt that venerable breeder, William M. Landrum, to say that they would make but a very small book.

During the Administration of President Polk, the Sultan of Turkey requested of him that he recommend some one who would experiment in the culture of cotton in Turkey. Accordingly, Dr. James

B. Davis, of Columbia, S. C., was recommended, and he received the appointment. The work done by Dr. Davis appeared to be highly gratifying to the Sultan, and so, upon his return, in 1849, the Sultan, desiring to reciprocate the courtesy of the President, presented him with nine of the choicest goats in his dominion. Col. Richard Peters, writing in 1876, says of these animals: "These doubtless were selected from the herds of Angora, a district of country lying among the Taurus Mountains, which traverse Asiatic Turkey, and which derives its name from its principal city, situated about 200 miles east of Constantinople." It does not seem, therefore, that Dr. Davis encountered any great difficulty in securing this first importation of Angora goats into this country; but the following extract from the Country Gentleman of 1856, somewhat romantic and a little exciting, was signed by one Richard Allen, of Tennessee. The article, in full, shows that he was probably of that class of writers of history whose personal interests were to be subserved:

> It may not be out of place in this connection to remark that great credit is due to Dr. Davis, of South Carolina, for the enterprise he exhibited in the introduction of the goat to this country. He was at the time in the employ of the Turkish Government, at a salary of $15,000, engaged in experiments upon the growing of cotton in the Sultan's dominions. He went out upon the recommendation of President Polk, to whom an application was made by the Turkish Government for the services of some competent Southern gentleman familiar with cotton culture. While there he determined to procure the goat from its native wilds. The story of the journey would be too tedious for my brief letter, and I will merely add that, with an expensive outfit at Constantinople, a perilous journey of months, and the loss of many men and camels, he succeeded in capturing and carrying off eleven of the famous animals, whose fleeces, in the shape of shawls, are so highly prized and coveted by the ladies of all civilized nations and for which prices almost startling have been paid by the wealthy.

Such a tale of fortitude and determination, added to the information in another paragraph in the same letter which stated that the entire yield of the particular flock about which he was then writing had been engaged in the city of New York at $8.50 per pound, from which point it was to be shipped to Paisley, Scotland, for manufacture into the shawls mentioned above, no doubt assisted in the sale of goats at $1,000 each.

In 1863, Hon. George A. Porter, of Baltimore, himself a breeder of Angoras, wrote to Mr. Diehl that, while occupying the post of United States consul at Constantinople, he "procured and shipped for Dr. Davis the first of these goats that were ever brought to this country." Just how much Mr. Porter was acting upon the courtesy of the Sultan it is difficult to ascertain.

Of the nine Angoras imported by Dr. Davis, seven were does and two were bucks. Besides these, according to Colonel Peters, there came in the same lot one purebred Tibet doe, several head of crosses between the Angora and Tibet goats, and quite a number of grade does bred from the common short-haired ewes of the country and his Angora bucks. Plate LII shows a pair of the Angoras imported by Dr.

Davis. The first is a buck, weighing 155 pounds and carrying a fleece of 7 pounds; the second is a doe, weighing 102 pounds, carrying a fleece of 4½ pounds. These pictures appeared in the Country Gentleman in 1856 and were furnished that paper by Col. Richard Peters, who was at that time the owner of the goats. Dr. Davis, not being familiar with goats, thought these were the famous Cashmere goats which furnished the fiber for the costly Cashmere shawl, and they were called Cashmere goats for many years after their introduction into the United States. The records show that as late as 1861 Mr. William M. Landrum, the veteran breeder of Angoras, was awarded a silver goblet and $25 in cash for the introduction of the first Cashmeres [Angoras] into California. Hon. Israel S. Diehl, writing on "The Goat" in the Annual Report of this Department for 1863, gives descriptions of different varieties of Angoras in Asia Minor, among which was one variety which might very easily be mistaken for the Cashmere. He says:

> There is also a second or other variety of Angora, or shawl, goat besides those generally described. This goat has an unchanging outer cover of long, coarse hair, between the roots of which comes in winter an undercoat of downy wool that is naturally thrown off in spring or is carefully combed out for use. A remarkably fine species of this breed exists throughout the area to which the white-haired goat is limited, and similar breeds prevail all over the highlands of Turkish and Persian Armenia, Koordistan, and at Kirman; and, although some flocks yield finer fleeces than others, it is called the same wool or under down as the wool of Cashmere and Tibet, and samples of the wool of the Tibetan and the double-wooled goat of the banks of the Euxine show them to be but varieties of the same species.
>
> This goat is of a larger size than those of the more southern Turkish provinces and its wool finer, and is the variety probably introduced by Dr. Davis from Asia Minor as the Cashmere, and now erroneously so called throughout the country, as all the importations of this country, as far as we can learn, were shipped from ports on the Mediterranean or Constantinople, several thousand miles from Cashmere or Tibet, through inhospitable and almost untraveled countries for Europeans, which goes far to prove the so-called "Cashmere goat" to be the Angora.

Mr. Diehl, in the same article mentioned above, describes the Cashmere goat. The difference between it and the Angora of our country will be seen to be distinct. The similarity of the variety of Angora described above and the Cashmere is marked, especially in respect of the downy undercoat. His description of the Cashmere is as follows:

> This variety of the wool-bearing or shawl goat, as it is often called, is spread over Tibet, Northern India, and the regions to the east of the Caspian Sea. It is somewhat smaller than the common and Angora goat. It has straight, round, pointed horns, pendent ears; is covered with straight and falling long, fine, flat, silky hair, with an undercoat in winter of a delicate greenish wool, of but 2 to 3 ounces each, which latter alone constitutes the fabric from which the celebrated shawls are made. Ten goats furnish only enough for a shawl 1½ yards square; but this is often found differing both in color and the quality of the wool, or rather the fine hair, of which the fleece is composed. The principal points in the most approved breeds are large ears, the limbs slender and cleanly formed, the horns not spirally twisted, and, above all, the fleece being long, straight, fleecy, and white.

This soft undercoat of the Cashmere is known as "pashum," and is the product from which the famous Cashmere shawl was made. Mr. William M. Landrum, who was probably the first in this country to discover that our so-called Cashmere goat was the Angora instead, through investigations made about 1861, also states that there is a difference between the Cashmere shawl and the Paisley shawl. These are often referred to as being the same shawl. While the filling of both shawls was of pashum, the chain of the latter was made from the kid fleece of the Angora. Pashum is combed out in the spring, and is worth, when cleaned, in the country where it is produced, from $1.50 to $2 per pound. A writer in the Penny Magazine (London) in 1838 says:

> The wool is first combed from the animal in the mountains of Tibet, where it is sold for nearly 5 shillings a pound. It is packed in baskets and sent to Cashmere, where it pays a duty on entry. It is there bleached with rice flour, spun into threads, and taken to the bazaar, where another tax is paid upon it. The thread is then dyed, the shawl is woven, and the border sewed on.

So much for the Cashmere goat.

The first (or Davis) importation of Angoras was frequently exhibited at fairs, and always attracted much attention. The reports made by the officials of fair associations were always favorable, sometimes flattering, and as is known, after years of experience, not always correct. The United States Agricultural Society, which held an exhibition in Philadelphia in 1856, awarded to Col. Richard Peters, who was then the owner of the Davis goats, $100 as a special reward. The following report was made upon the animals:

> They have become known as Cashmere goats from the pure white color and fineness of their fleeces, and their undoubted Eastern origin. The fleeces from the bucks weigh from 6 to 7 pounds, those from the ewes from 3 to 4 pounds. The flesh of the crosses is superior to most mutton, tender and delicious, making them a desirable acquisition to our food-producing animals.
>
> The ease with which they are kept, living as they do on weeds, briers, browse, and other coarse herbage, fits them for many portions of our country where sheep can not be sustained to advantage, while their ability and disposition to defend themselves against dogs evidence a value peculiar to this race. They are free from all diseases to which sheep are liable, hardy and prolific, and experience has proven that they readily adapt themselves to all portions of the United States. The bucks breed readily with the common goats, the second cross yielding a fleece of practical utility, whilst the fourth is but little inferior to that of the pure breed.
>
> A flock of valuable wool-bearing goats can be raised in a few years by using grade bucks.

The following extract is from a report of the special committee appointed by the American Institute at its exhibition in New York City in 1855:

> They have examined with much interest the fleece submitted to them, and as well from their own observations as from the results of a microscopic examination made

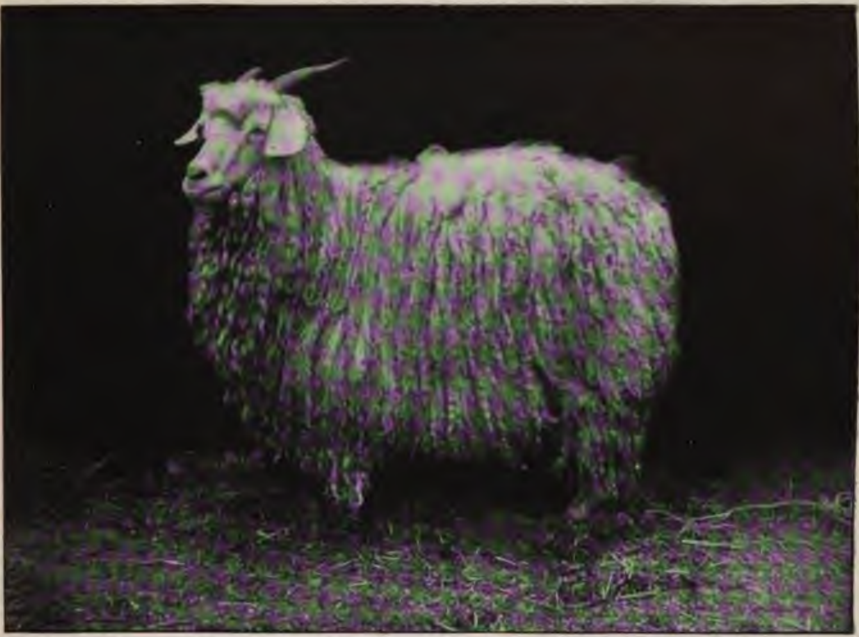

FIG. 1.—MADAM LADYSMITH, THREE YEARS OLD. FLEECE, 8 POUNDS.
(Photograph furnished by C. P. Bailey & Sons Company, San Jose, Cal.)

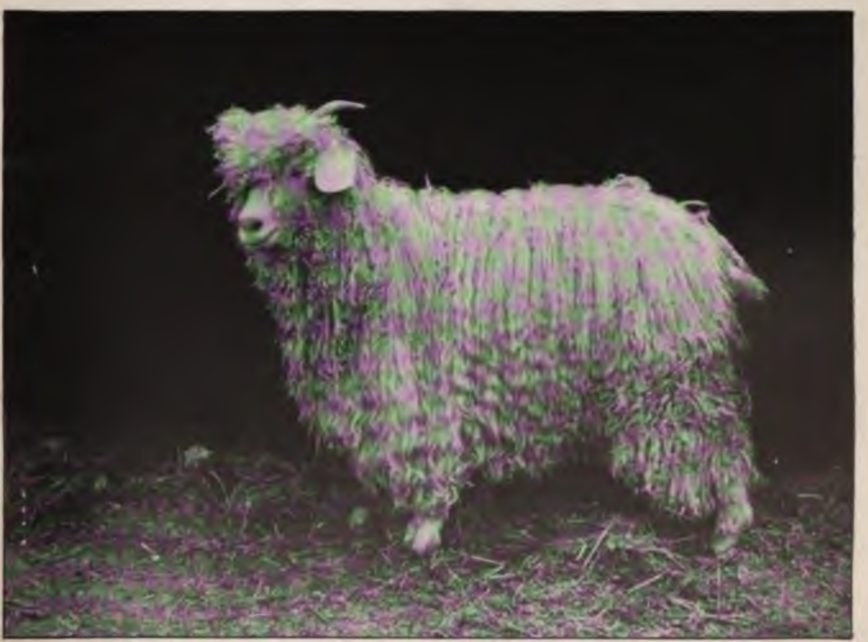

FIG. 2.—PRINCESS MONTEREY, TEN MONTHS OLD. FLEECE, 4½ POUNDS.
(Photograph furnished by C. P. Bailey & Sons Company, San Jose, Cal.)

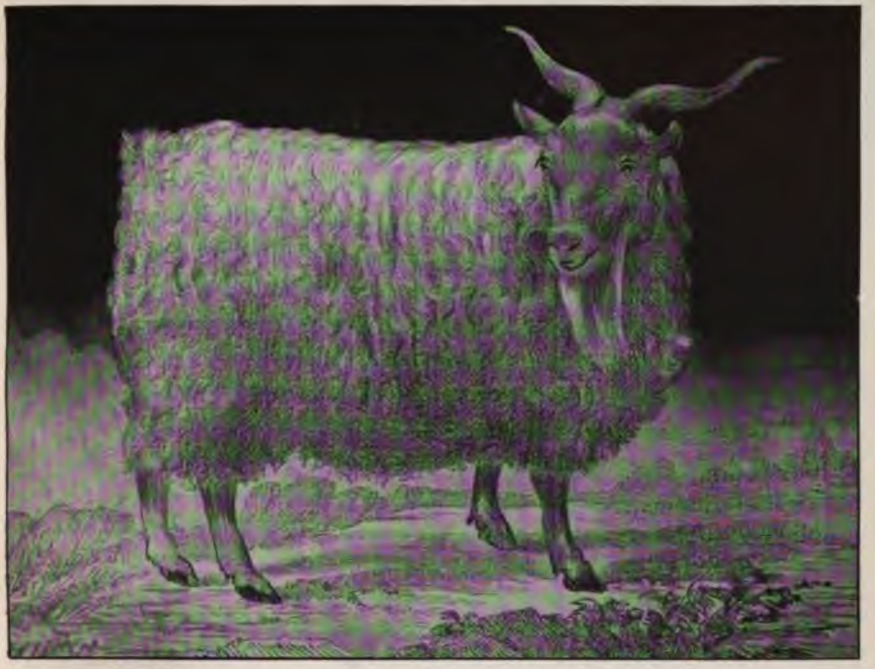

FIG. 1.—ANGORA BUCK. (DAVIS IMPORTATION, 1849.)

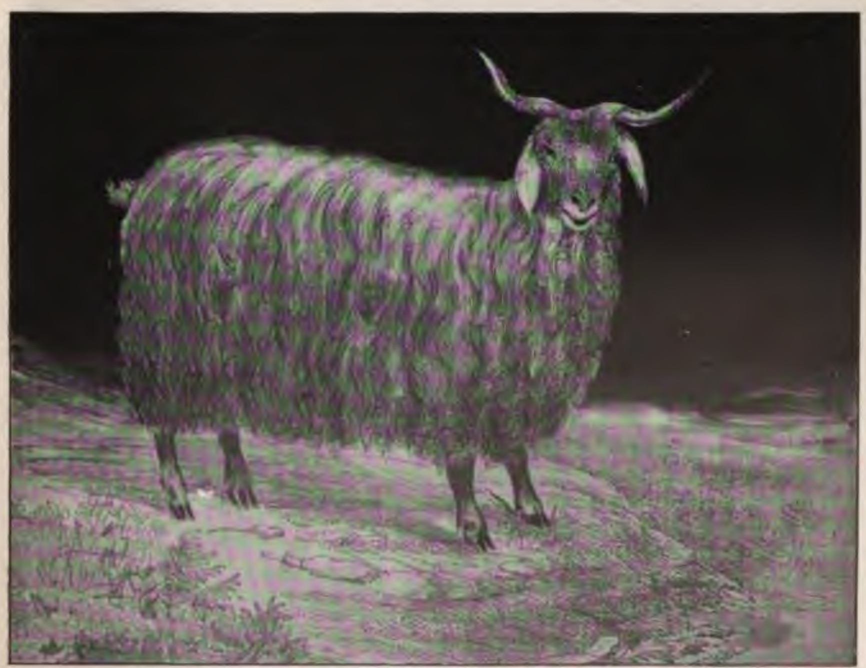

FIG. 2.—ANGORA DOE. (DAVIS IMPORTATION, 1849.)

and certified to by several gentlemen of scientific eminence well known to them, they are convinced that the fiber of these fleeces is identical in character, and fully equal in value, to that from which the highly prized Cashmere shawls were made. The fleeces on exhibition, and now under examination, amount to from 4 to 8 pounds each.

The enterprise exhibited by the introduction of these animals into this country and their propagation can not be too highly regarded.

First. These animals are long lived, such being the case with the whole goat race.

Second. They are prolific, breeding at the age of 1 year, with a period of gestation of about five months, and yielding twins almost universally after the first birth.

Third. They are hardy, experience having shown that they will thrive well in our climate from Georgia to New England, and that they require coarse and cheap food—as the inferior grasses, briers, bushes, etc.—such as is refused by other grazing animals.

Fourth. They produce a fleece of from 4 to 8 pounds, valued at from $6 to $8 per pound in France, or Paisley, Scotland, for the manufacture of those high-priced shawls. These fleeces can be produced, when the animals become numerous, at a less cost than the common sheep's wool and far superior to it.

Another fact of great practical value to our agricultural interests is the facility with which the Cashmere goats breed with the common goats of our country.

From these and other considerations, of the correctness of which your committee have entire confidence, it will be obvious that every encouragement should be shown this new enterprise—a bold and judicious movement.

B. P. JOHNSON.
CHARLES J. GOODRICH.
JAMES J. MAPES.

A committee for the New York State fair, held in New York City in 1854, reported as follows:

The undersigned can not avoid the conclusion that in the goats imported, and whose descendants have been the subjects of this examination, we have the first-known specimens of that valuable race of animals from whose hairy fleece the celebrated shawls are manufactured known in commerce by the inappropriate name of "red camel's hair." As the fleece does not appear to have deteriorated in the comparatively warm climate of South Carolina, the distinctive character of the race is hard to be obliterated, while in the northern region of the United States this character can not well fail to be permanent. Viewed in this light, the introduction of this animal promises to be of more value to the agriculture of the United States than that of almost any other animal.

JAMES RENWICK.
JOSEPH R. CHILTON.
W. H. ELLET.

Many other similar reports were made by committees of fair associations about that time, but those quoted serve to show how favorably goats were regarded. It should be stated here, however, that there are in these reports many erroneous statements. For instance, the goat is not the Cashmere; they drop twins occasionally only, and their fleece never did bring as high as $6 to $8 a pound.

All of the Davis importation of purebred Angoras were purchased in 1853 by Col. Richard Peters, of Atlanta, Ga., with the exception of one owned by Col. Wade Hampton, of South Carolina; one sold by Dr. Davis to Mr. Davenport, of Virginia, and one to Mr. Osborne, of New York. Colonel Peters later imported others from Asia Minor, which did not prove to be very satisfactory, as they were gummy. The Savannah Republican in April, 1860, said that Colonel Peters was selling his goats at very high prices, having received $1,500 for one buck; that the president of an Illinois fair was so pleased with one of the bucks on exhibiton there that he offered Colonel Peters "the weight of the buck in silver for it." Colonel Peters is looked upon as the real founder of the Angora goat industry in the country. Although Dr. Davis had crossed the Angoras with common goats to some extent, it was Colonel Peters who demonstrated the possibility of erecting an excellent fleece-bearing flock by judicious crossing with common goats. Other importers were Hon. W. H. Stiles (1860), 8 head; Diehl & Brown (1869), of Ohio, of 135 head; Price Maurice, of Australia, who imported 1 buck and 2 does for his sons, who were settled at Fort Clark, Tex.; John S. Harris (1876), then of California, now of Oakley, Idaho; C. W. Chenery (1867), of Massachusetts. A. Eutychides (1869?), a native of the province of Angora, brought over a flock numbering 175 and made a vigorous effort to bring them more largely to the notice of the American public. After several years of doubtful success he returned to the Old World to engage in farming in Thessaly.

John S. Harris says that, with the exception of Hon. Israel S. Diehl, he is the only man who ever went into the province of Angora for the mohair goat; other goats that were imported came through agents.

These are about all of the earlier importations from Asia Minor. Of recent years some excellent individuals have been brought from Cape Colony. Turkey has since 1881 prohibited the exportation of Angoras, and Cape Colony, observing with jealous eye the rapid progress now being made in the United States, has placed an export duty upon Angoras of £100 ($486.65). W. Hammond Tooke, writing of the mohair industry of Cape Colony in the Agricultural Journal of the Cape of Good Hope, says they have nothing to fear from Turkey or Australia, but that the United States gives them more concern, as the breeding of Angoras for mohair is no longer considered an experiment in the United States.

Previous to the outbreak of the civil war there were many fair-sized flocks in the South and Southwest. There were smaller flocks in many of the Northern and Western States. Mr. Diehl, in 1863, mentions flocks containing from 300 to 1,200 and more in Atlanta, Ga.; Gallatin and Nashville, Tenn.; Russellville, Frankfort, Paris, and

Georgetown, Ky.; Greenville, Lebanon, Montgomery, and Bucyrus, Ohio; Green County, Ind.; Chicago, Decatur, and Evanston, Ill.; St. Louis, Maramee, and Fayette, Mo.; Baltimore, Md.; Leavenworth, Kans.; Brownsville, Pittsburg, Washington, and Philadelphia, Pa.; New York City, N.Y.; Boston and Belmont, Mass.; Austin, Tex.; and in the States of Iowa, Michigan, Minnesota, California, and in other localities. So it will be observed that they were so distributed as to test in a most excellent manner the several phases of our climate upon them. On account of the civil war, however, little or no progress was made in the South, where the largest herds were located and where most interest was manifested, until about 1866. Soon after the close of the war they spread out into the West, principally into Texas and California, where the natural conditions were most favorable, and where they have, quite unknown to the public, increased wonderfully in numbers and, in the light of recent events, in importance also.

In the spring of 1861 Colonel Peters sold two 16-months-old bucks to William M. Landrum, of San Joaquin County, Cal. They were sent from Atlanta to St. Louis by express; thence by steamer to Fort Leavenworth, and thence on foot to California with a wagon train. They subsisted on the journey by browsing on what other animals rejected, and arrived at their destination uninjured and in good condition. Mr. Landrum exhibited them at the State fair the same year, being awarded a silver goblet and $25 in cash. One of the goats, after siring about thirty kids, died of snake bite; the other one, famous on the Pacific coast under the name of "Billy Atlanta," lived to be 10 years old, and then was accidentally killed. He had sired about two thousand kids. This buck won the sweepstakes prize over all competitors at every State fair down to his death; and Colonel Peters stated in 1876 that his numerous descendants were scattered all along the Pacific coast, and that "his blood courses in the veins of over one-half the Angora flocks in that part of the Union, estimated to approximate 70,000." Colonel Peters further stated "that about one-third of the purebreds introduced into California were contributed from the first and original (Davis) importation of 1849, and that their blood is present in probably two-thirds or three-fourths of the Angora stock on the Pacific coast."

Mr. Landrum was in California from 1850 to 1883, after which time he went to Texas. He is now at Laguna, Uvalde County, Tex., and, with his sons, is still interested in the Angora goat industry. The Chenery importation was shipped by the British consul in Angora to Constantinople, where they were sorted by Mr. John R. Thompson and the American consul, and shipped by a sailing vessel to Boston.

Ten head of the Chenery importation were taken to California and disposed of as follows: A pair to C. P. Bailey, San Jose, at $500 each; a pair to Thomas Butterfield & Son, Watsonville; a pair to William M. Landrum, San Joaquin County; a pair to Mr. Pierson, Santa Cruz; and a pair to Flint & Sargent, Monterey County. This lot was the beginning of the breeding of thoroughbred Angoras in California. Prior to this but two Angora bucks had been taken into the State—the two which were sent by Peters to Landrum.

The Diehl and Brown importation was first taken to Ohio; and afterwards the entire lot, it is believed, was taken to California, where the goats were widely disseminated through the State, some of them bringing as much as $200 a head.

In 1875 William Hall bought of Butterfield & Son their entire flock of 150 goats for about $17,000. The same year John S. Harris joined Hall as a partner, and the following year went to Turkey and purchased ten does and two bucks. These also went to California. It is said that the blood of this importation was felt beneficially in every good flock in the State.

In 1893 C. P. Bailey imported from South Africa two bucks. Pasha (see Pl. LVIII) was one of these, and his get has been sent to nearly every State in the Union. In 1899 Mr. Bailey imported another buck from Cape Town. This animal is the last importation into the United States.

The statement has already been made that the first goats taken to California were purchased of Colonel Peters by Mr. Landrum. In 1872 Mr. Landrum purchased all the goats under 8 years of age which Colonel Peters then owned and took them to California.

Mr. Julius Weyand, secretary of the Angora Goat Breeders' Association of California, in a report to that organization in 1891, gives a brief review of the industry in that State. He says that in 1885 there were about 100,000 Angora goats in California, but between that date and 1889, owing to the admission into the United States of mohair as carpet wool, and thus paying but 2½ cents duty per pound, the number decreased to 55,000. Mr. C. P. Bailey is authority for the statement that practically all the goats in California are of the Angora breed.

Large flocks of Angoras have been sent from California and Texas into Nevada, Oregon, and Washington, where they have been divided into smaller flocks and become the property of many different farmers. Texas has also sent many over into New Mexico.

Although the foregoing facts show that the Angora goats have been slow in gaining a standing among the industries of the country, it can hardly be doubted that there are now in motion such energies as will place the industry upon a rational basis. It is believed that the Angora industry is already emerging from the chaos which has enveloped it for fifty years past, and that it will soon be as firmly established as any other stock interest in the United States. A recent issue of Wool Markets and Sheep says:

> After careful review of the situation, past and present, the Angora goat industry of this country we clearly conceive is destined to be one of very great importance in our agricultural economy. Our broad acres and diversified geological and climatic conditions give ample scope and abundant suitable conditions for the carrying on of the business to a large extent and profitable issue.

DESCRIPTION OF THE ANGORA GOAT.

Mr. Israel S. Diehl, bearing a commission from the Commissioner of Agriculture, visited the province of Angora in 1867 to investigate the mohair industry. Here, where there were once in operation 1,700 to 1,800 looms working up the mohair fleeces, he found but a few hundred remaining, struggling hopelessly against the fatal competition of European machinery and the aggressive policy of the European Governments. The fleeces were exported to Europe for fabrication, thus rendering Turkey tributary to the monopoly then existing in this industry in Europe. The European demand for the raw material was so great and the facilities to fabricate it so much better and cheaper that Turkey was compelled to export the raw mohair. In order to meet the demands for manufactured mohair the Turkish growers, without wise foresight, began the practice of crossing the Angora upon the common Kurd goat of that country. The inevitable result of such a policy was to bring about to a large extent the conditions which have obtained in the United States, namely, a breed of Angoras of uncertain purity. This fact, coupled with the belief that proper care was not exercised in selecting the animals exported to this country and that they have been carelessly bred here, has led some excellent judges of Angoras to express the belief that there are really no purebred Angoras in the United States.

These conditions have produced various types of Angoras, even in Asia Minor, and a minute description of one would not apply to all. Some strains have fox-like ears, while others and generally preferred ones have long pendent ears. In this country care must always be exercised to cull the offcolored kids out of the flock. These may be the result of atavism, where a cross was made upon a common goat either red or black; but it is reported by some that different colors are found in the province of Angora among what were supposed to be purebred animals. Mr. Gustav A. Hoerle, one time corresponding secretary of the American Mohair Growers' Association, and an authority of note on Angora goats, mentions having yellow and red goats in his own herd, and said that "some of the kids became quite a variety show."

Mr. S. C. Cronwright Schreiner, of Cape Colony, in his excellent work on "The Angora Goat," has compiled the descriptions of almost all writers on Angora goats. He quotes Mr. Henry O. Binns, who spent twenty years in the mohair districts of Asia Minor between 1864 and 1886, and who studied them during that time, as follows:

> The pure Angora in his prime is about the size of a five-months-old Cape [Cape of Good Hope] kid, with small thin horns, wooled all over the body, their hair almost covering the eyes; exceedingly delicate, and so subject to disease that no one cared to keep him. What is to-day called the purebred Angora is like the English thoroughbred horse—the result of crossing and recrossing until body, class, points, etc., have attained to what is generally considered that the thoroughbred Angora ought to be.

Mr. Schreiner's opinion of what a purebred Angora is, given on page 58 of his book, is as follows:

> I think it is certain that the original purebred white mohair goat was a small, very refined, delicate animal, of great beauty, clipping at twelve-months' growth of fleece about from 2 to 4 pounds (according to age and sex—kids considerably less) of dazzling white, fine, soft, silky, very lustrous mohair, curling in ringlets from 10 to 18 inches long, with merely the minimum of oil in its fleece requisite to the growth of hair of the highest excellence, so small in amount as to be inappreciable to the unskilled observer. It was perfectly clothed in every part; it had short, silky, curly hair about the face and down the lower parts of the legs to the hoofs; a soft, silky, curly "kuif" (tuft on the forehead), and small, thin, light-colored horns. The ewe was of course smaller and finer than the ram, and had only one kid at a birth (of this there is abundant evidence).

Although Mr. Schreiner thinks the Davis importation to this country was among the best bred goats that ever left Turkey, it will be noticed from the pictures of two of them shown herein (see Pl. LII, p. 000), which were said by Colonel Peters to be excellent, that the mohair does not extend "down the lower parts of the legs to the hoofs." It is doubtful if any such Angoras may be found existing at this time, however probable they might have been in their original purity.

The following is quoted from Dr. John Bachman,[1] of Charleston, S. C., who was appointed by the Southern Central Agricultural Association of Georgia to report on the Angoras belonging to Colonel Peters, of Atlanta:

> The Angora goat, more especially the varieties it has produced, is described by Hasselquist (1722–1752), Buffon (1707–1788), Pennant (1726–1798), and others as in general of a beautiful milk-white color, with short legs, and black, spreading, spirally twisted horns. The hair on the whole body is disposed in long pendent spiral ringlets; its ears are pendulous, and the horns of the female, instead of divaricating as in the male, turn backward, and are much shorter in proportion.

Mr. Diehl[2] (1863), adopting to some extent the same language as Dr. Bachman used, describes the Angora as follows:

> The Angora goat, and more especially the varieties it has produced, are probably the most valuable of all the goat family, and have been ably described by Naturalists Buffon, Pennant, Hasselquist, and travelers as good-sized animals, generally of a beautiful milk-white color, with short legs and wide-spreading, spirally-twisted horns. The wool is described as a very beautiful curled or wavy hair of silvery whiteness, with a fine downy wool at its base, and this hair is disposed in long, pendent, spiral ringlets on the whole body. The horns of the female, instead of spreading, as in the male, turn backward, and are much shorter in proportion. Those of the male are long, spirally twisted, but the size and direction are very different from the common goat, being generally extended from 15 to 30 inches in height on each side of the head, while those of the female are near the ears. The hair, or wool, often sweeps to the ground, and is usually from 5 to 12 inches long, especially in the older bucks, but then not so fine.

This brief description, he said, applied to all the Angoras which he saw in western Asia, Europe, and in this country, which amounted to several thousands, except as to a difference in ears, for, while some had pendent ears, others which he examined had ears exceedingly small and short.

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[1] "Report on Asiatic Goats," United States Agricultural Report, 1857, p. 58.

[2] "The Goat," United States Agricultural Report, 1863, p. 222.

Mr. Diehl also mentions a variety of this goat in Angora which was hornless. There is reason to believe that an intelligent system of breeding would produce such result. Such an end has been attained with cattle and is entirely feasible with goats.

In this connection, interest will be manifested in a note from Col. William L. Black, of Fort McKavett, Tex., who says he has an interest in a flock of hornless Angoras in Iowa. He says that there is no doubt that it is a "distinct breed." His experiment the first season was seven hornless kids from eight does with horns, and the second season (1900) he raised "fully 90 per cent of hornless kids." Hornless Angoras, however, were not very rare in Asia Minor, and it may be that there were some in the vilayet of Angora. They were called Kastamoonee[1] Angoras, taking the name from the vilayet of that name. The vilayet joins that of Angora on the north and forms a part of the northern boundary of Asia Minor. Several years ago Mr. William M. Landrum imported one of these Angoras. He was known as "Hornless Johnnie." Mr. Landrum was not very proud of this animal, as would appear by this from his pen in 1899:

> He sheared 10 pounds at six months, but his hair was too coarse for anything but wigs. I bred him to a lot of purebred Angora ewes and got the best lot of bucks for low-grade ewes that I ever saw; got $50 premium for them over purebred Angoras. I paid $2,000 for him, and lost him the second year. If he had lived I would have injured my purebred flock with him. As it was, I killed for mutton several ewes got by him from purebred ewes to get them out of the flock. I could not certify them to be pure Angoras.

It is to be hoped that Colonel Black's efforts to originate a hornless variety will produce better results than were obtained from Hornless Johnnie. Of course, the presence or absence of horns need not necessarily have any influence upon the qualities of a goat.

Probably the best description of the American Angora is that given by Mr. Gustav A. Hoerle, which is given below. Reference is to first-class animals, and not to grades of various degrees:

> The body should be long, and the rounder the better; the back straight, with shoulders and hips equally high from the ground; shoulders and quarters heavy and fleshy; chest broad, indicating good constitution; the legs should be short and strong; the head is in shape like that of a common goat, but less coarse and cleaner cut; the horns are heavy, with an inward twist, inclining backward and to the outside.
>
> Except just the face and legs, from the hocks and knees down, the entire animal should be densely covered with mohair, and neither the belly nor the throat nor even the lower part of the jaws should be bare, but should have a good covering of fine, silky mohair, and with the finest specimens the mohair tuft on the forehead should be well developed. The mohair should hang in long, curly ringlets. However, not every Angora goat which shows these perfectly curly ringlets of the mohair

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[1] This name is variously spelled—Kastamoonee (preferred by Lippincott), Kastamouni, Kastamuni, Castambool, Castambul, Costambone.

must necessarily be considered a thoroughbred; whilst, on the other hand, there are quite a number of really handsome and valuable thoroughbreds whose hair has not that much-desired shape, owing entirely to climatic and nutrimental influences, as well as to advancing age. Thoroughbreds and all nonshedding grades can easily be recognized by the peculiar shape of "points" of their mohair, each end showing plainly that it has been "cut off," instead of running gradually to what is called a "steeple point," which is found with the hair of all kids and of shedding grade Angoras. The plainer and longer this blunt point shows toward the end of the year the better is the fiber of the mohair, and the more valuable is the hair for combing purposes and the smaller the percentage of noilage and waste. After shedding, as well as nonshedders after shearing, the mohair grows very rapidly for some months. It grows slower toward the end of the year, and, with very bad climatic and nutrimental influences, almost stops growing entirely. Therefore, if the late fall shearing is practiced, Angoras need good care during winter. The more even in length and quality the mohair is on all parts of an Angora body the better. When in full fleece the body of a fine thoroughbred Angora should appear like a right-angled square, with no gaps or deficiencies of covering, especially below the belly.

Mr. Hoerle is encountering some opposition to his ideas of the nonshedding varieties. Because of this difference of opinion the Bureau submitted the question, "Do thoroughbreds (fourth cross or above) shed if not sheared?" to a large number of the breeders of the country. A summary of the replies received is given elsewhere (see p. 000).

A characteristic of the common goat that is very objectionable is the ever-present offensive odor from the bucks; in the Angora breed this odor is entirely absent, except at the rutting season, and then it is noted in a slight degree only. The odor in a fleece of mohair is milder than that in a wool fleece, and is not at all offensive.

NAMES OF THE BREED, THE SEXES, AND THE MEAT.

NAME OF THE BREED.

There was no difficulty in dropping the name "Cashmere" as soon as it was known that the Angora goats did not belong to that breed, but there are a few uninformed persons who still refer to them as Cashmeres. Owing to the prejudice existing against "the goat," it has been suggested and strongly urged by some that the easiest and quickest manner of ingratiating the Angora goat with the people is to drop the word "goat" altogether and call them simply "Angoras." In other words, it is proposed to pretend that this animal does not belong to the goat family. It would still be a goat notwithstanding, and students of science would forever be pointing out the pretense. Besides, the use of the name "Angora" alone would almost certainly lead to the commission of errors. Everything of American origin is referred to as being "American," and the various animals from the vilayet of Angora could with equal propriety be called "Angoras." For instance, the long-haired cat from that province is quite well known in this country and is called an "Angora."

The American people desire to know things by their right names. This is a principle more deep seated than mere prejudice. A great amount of prejudice had to be overcome before the tomato was generally used for food, and we can imagine in a degree what was said of the first man who ate an oyster or a mushroom. But these "poisonous" and "nasty" things are now recognized everywhere not only as delicacies but as most nourishing food. So will it be with the flesh of Angora goats when it is generally known that it is palatable and nutritious. A perusal of the many reports received by the Bureau of Animal Industry shows that there is no objection to Angora goat meat in those localities where these goats are raised.

The Angora has everything to recommend it—nothing to condemn it; and there seems to be no real good reason why its identity should be lost by dropping the name "goat." Whoever sees the animal can not fail to admire it, and whoever eats of it is quite certain to like it if he is at all fond of mutton; and the prejudice against it will disappear as the industry expands and develops throughout the country. Indeed, a knowledge of the Angora goat shows that the existing prejudices will not hold against it; that those prejudices are based upon the reputation of the common goat.

NAMES OF THE SEXES.

There are no well-established names for designating the sexes of goats. The male is indiscriminately called "male," "sire," "buck," "ram," and "billy," and the female, "doe," "ewe," and "nanny." Oftentimes a writer uses two or more of them in one article, showing that he has not adopted any of them. One of the questions submitted to the men was this: "As to designation of sex—do you call the male "buck," "billy," or "ram," and the female "ewe," "nanny," or "doe?" More than half of those who replied called the male "buck," and nearly half called the female "doe." The objection of one writer that the plural of the female, "does," conflicts in reading with the verb "does," will not hold, as a sentence will not "make sense" with the one word used for the other. In this bulletin it has been decided to refer to the sexes as "buck" and "doe."

The castrated animal is called "wether," as with sheep. In Cape Colony he is called a "kapater," and the sheep wether is there called a "hamel;" but there is no reason why we should adopt these terms.

The young is called the "kid." There seems to be absolute unanimity in this matter.

NAME OF THE FLESH.

Our correspondents are apart in the use of the terms "Angora mutton" and "Angora venison" for the flesh of the Angora goat, but the greater number of them call it by the former name. Those who pastured their goats upon some grass or clover as well as upon browse, and then finished their fattening with grain, produced a meat so nearly like the best lamb that it required experts to detect a difference; these people use the term "Angora mutton." In other instances, where the animal is fattened by browse alone, there is imparted to the meat a game flavor, which may be intensified or reduced by the character of the browse; people who use the meat under these conditions call it "Angora venison."

Some correspondents, with evident thoughtlessness, refer to the meat as "goat meat." This is a serious blunder if a successful effort is to be made to popularize the use of Angora mutton, as there is a wonderful difference between the flesh of the common goat and that of the Angora. For this reason the prefix "Angora" should never be omitted.

THE USES OF ANGORA GOATS.

A large class of people in some way have become possessed of the opinion that the goat is practically a useless animal. They do not reach conclusions upon investigations, however, and do not discriminate between the different breeds. To them a goat is a "goat," and there the argument ends. Investigations prove that the Angora goats are not only classed among the most useful of the domestic animals, and have been so classed for thousands of years, but their usefulness is manifested in a variety of ways. The fleece, called "mohair," furnishes some of the finest of fabrics among ladies' goods and is used in various other manufactures; their habit of browsing enables the farmer in a wooded locality to use them to help in subjugating the forest; their flesh is exceedingly delicate and nutritious; the milk, though not so abundant as with the milch breed of goats, is richer than cow's milk; their tanned skins, though inferior in quality to the skins of the common goat, are used for leather; their pelts make the neatest of rugs and robes; they are excellent pets for children; a few of them in a flock of sheep are a protection from wolves and dogs; their manure is noticeably helpful to the grass which follows them after they have cleaned away the underbrush. These are all vital subjects of varying degrees of importance, and will be considered here under appropriate heads.

BROWSING AND PASTURAGE.

Ability to clear brush land.—Goats are browsers by nature, and there is no vegetation they will eat in preference to leaves and twigs of bushes. While this fact would at once establish them as an intolerable nuisance in an orchard or garden or any other place where desirable shrubbery is growing, it also shows that they may be of great value in many localities where it is desirable that underbrush be destroyed. They are omnivorous eaters and seem particular to avoid that character of vegetation which other kinds of live stock prefer. Every leaf and every twig within their reach is greedily eaten, even to most of the bushes and weeds that are considered poisonous to other ruminants, while a remarkably few weeds are passed by. They will desert the finest clover and blue grass for such an outlay.

The inherent tendency to climb leads them to hillsides and rocky cliffs, and they prefer such situations to any of a level character. Here nature meets their necessities by dwarfing the bushes so they may be browsed easily; the soil is quickly drained in the event of rain—for they do not like wet land; and the stones serve to keep the feet trimmed properly by the wearing process. This is the situation that the goats would choose; but the farmer might choose to turn them into a dense mass of brush and weeds anywhere and they will at once begin to convert it into the most beautiful pasture.

In those localities where valuable land is completely subdued by brush the goats are considered of more value for the purpose of clearing it than for their mohair or meat. They thus become one of the farmer's important tools. Their value in this respect must be measured by the value of the land which they will render cultivable. It is said that in Oregon, where Chinamen had been paid as high as $20 an acre for clearing off brush, goats had done the work even better. Sprouts will spring up behind men's work, but goats will keep them down until they cease to appear. True, the goats require more time than men, but their work is better. In this connection an article which appeared in the Country Gentleman of January 11, 1900, is of special interest:

> In 1870 Mr. Landrum exhibited ten head at the Oregon State fair. They were put in a brush pen, where they ate out the brush and peeled the saplings during the fair. As the Willamette Valley was covered with brush and farmers were paying Chinamen $20 and Americans $22 per acre for grubbing, Mr. Landrum suggested the employment of goats instead; and, to demonstrate their effectiveness as substitutes for grubbing, he left them on 3 acres of slashed brush. At the end of the first year the roots were dead and discolored, and at the end of the second year they were rotten and the land mellow for the plow. Then he drove up his California herd of 2,400, the result of fifteen years of breeding, and sold them in small lots from Jacksonville to Portland, scattering them throughout the Willamette Valley. He says he sold as many more later to go to Oregon, where there are now 80,000 head, mostly in lots of 25 to 300. * * * He believes that they are more profitable than any other farm animals. They have cleared hundreds of thousands of acres of brush land in Oregon now in cultivation.

Through the courtesy of Dr. J. R. Standley, of Platteville, Iowa, three illustrations are presented which, as he naively states, shows woodland "before goating, during goating, and after goating." Words can not possibly emphasize the work of goats as brush destroyers so strongly as these illustrations. The first (Pl. LIII) shows simply a dense mass of hazel, plum, crab apple, several varieties of oaks, and weeds as high as the fence. This land was as nearly like that shown in the other illustrations before goats were turned in them as it was possible to find. The second (Pl. LIV) shows a piece of land while goats were operating on it. It will be observed that the brush is dead, and that the weeds only appear to be alive. The third (Pl. LV) shows the "finished product" after two years. The goats had been in the tract shown in Plate III but twelve months when this photograph was taken. The shrubbery that was too large for the goats to "ride down" was cut down, the goats completing the work by eating the soft twigs and leaves. The last piece is ready for cultivation or for pasture for cattle, sheep, or horses. When the goats were first turned into this tract it was as full of brush as the tract shown in Plate LIII, and they were allowed to run upon it but two years.

The beneficial effect of the goats is not all in the clearing of the land of brush. In many parts of the country nutritious grasses "come in" after the goats have done their work. In the tract shown (Pl. LV) blue grass has by natural methods formed a most excellent pasture. The final result is that the goats not only put such character of land in condition for cultivation, but actually go further by converting a wilderness into a good pasture, thus preparing the way by cheapest methods for sheep, cattle, or horses.

Dr. Standley says that in that part of Iowa where he lives "100 Angoras to each 40 acres of this land for two years would make it as clean as a lawn and as perfectly set in blue grass as a lawn." He has 500 acres of such land cleared in this manner. This land now supports one steer to each acre, whereas before it was cleared there was not enough grass on an acre to make a sheep or goat a single feed. The same experience is reported by Mr. Q. M. Beck, of Beargrove, Iowa, who says: "After running them on such lands here a few years we have a fine blue-grass pasture."

Dr. Standley's experience in the employment of goats for clearing land is extensive, and thousands of goats have been taken into Iowa upon his recommendation. It will interest the readers of this paper to see the following from his pen:

> Land can be cleared of the worst brush known to this country for a little less than nothing by Angora goats. Some one asks how. Simply this: Angora goats will pay a profit and live on leaves and weeds, leaving the land cleaner and nicer than can be done in any other way. Many persons have the idea that goats bark the trees and in that way kill them. They also think that goats wholly eat the hazel and other small brush. There is nothing in this. Goats are no worse to bark trees of any kind than sheep. The way in which goats kill brush is by continually cropping the leaves, which serve as the lungs of the brush. The continued cropping of the leaves makes the brush, as it were, sick, caused by lack of nourishment. This sickness sinks to the very extremity of the roots, thus preventing sprouting. Any and all kinds of bushes are in this way easily killed. Some kinds of brush and some kinds of stumps are of course much harder to kill than others. Many varieties are entirely killed by one summer's trimming of the leaves. Almost any are killed by two years'

trimming. To clear the worst brush do not cut anything that the goats can reach or bend. The tallest or largest is better not cut. All trees and saplings should be cut, and the goats will keep all the sprouts down. If stumps are allowed to sprout one year before the goats are turned in, the sprouts need not be cut. About 200 goats for 40 acres of brush will in two or three years make the land as clean as a garden. If the pasture has only patches of brush, turn in a few goats and it will make more grass for other stock than if the goats were not in. They eat very little grass when they can get leaves. Goats even like weeds better than grass. In clearing brush land in the old way by grub and plow there are always left many eyesores in the way of brushy nooks and bends and steep places which can not be plowed.

There are millions of acres of land in nearly every State in the Union which might be much more than doubled in value by the use of Angora goats at no cost at all. Commence and count the worth of your land, then the fencing, and see if you can afford to leave your brush land so nearly worthless for all time. Then count the cost of grubbing and plowing, if indeed such land is susceptible to the plow. No man can afford to grub and plow brush land in this day and age of the world any more than he can afford to plant a large field of corn without a planter. In hilly or mountainous portions of the country the Angora goat can be made to do a great service in the way of clearing the underbrush, when the land will bring grass after the brush is gone. It would surely be a paying business to buy up large tracts of rough land in the mountain districts, or indeed any brush land in the United States, and clear the brush and set in grass. Afterwards, if the owner liked other stock better, he might dispense with the Angoras. In many places where the country is too bare to furnish sheep with sufficient feed goats will do exceedingly well. In many places where leaves are abundant and there is scarcely any grass, making it impossible to profitably keep sheep, goats will do admirably well.

While Dr. Standley's experience is that goats will not to any appreciable extent peel the bark off shrubbery, the experience of others is quite the reverse. Mr. H. T. Fuchs, of Tiger Mill, Tex., writes in the Farm and Ranch of October 6, 1900, that one summer he purchased some Angora goats which came from a range where they had killed out all the tall sumac trees. On his own range was much of this brush, and his goats had never touched it. It was a treat for the newly purchased goats, and they "peeled the bark nicely and cleaned off every sumac tree in the pasture as high as they could reach (about 6 feet), and in a few days you could see the white, smooth-peeled trees with their dead tops for miles all over the pasture." He adds that fifty men with hatchets could not have done the work so fast or with so much pleasure. Further, he says the goats that had all along been in the pasture "took the hint and went at the bark peeling also." All of which goes to show that the goat is an intelligent animal and is capable of learning much by observation.

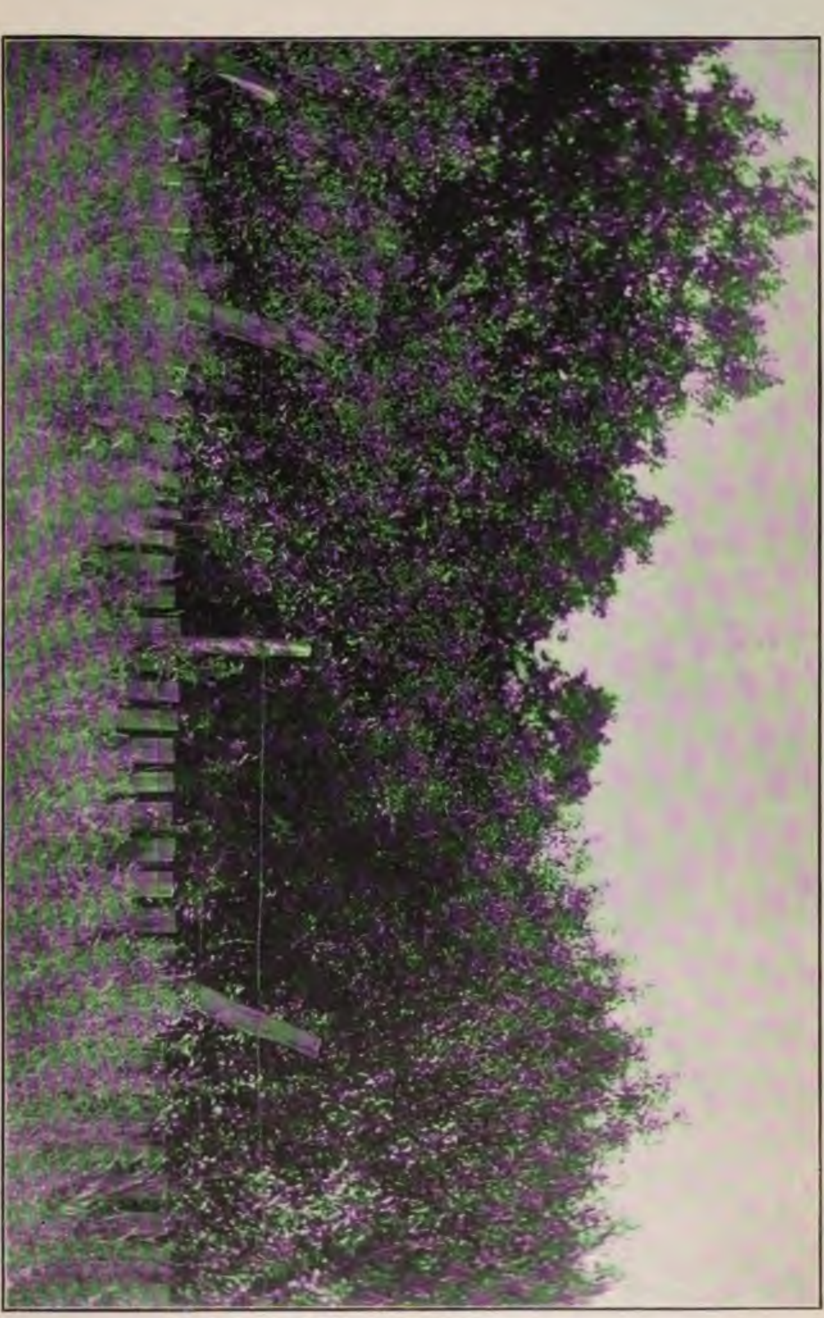
Mr. Q. M. Beck, of Beargrove, Iowa, writes that he had goats on a 23-acre tract, fenced, in one corner of which were 5 acres of clover suitable for hay. The goats not only cleared the way for the clover, but ate the browse instead of the clover. The goats were turned into this piece last June (1900), when they could hardly be seen on account of the brush, while now (September) they can be seen anywhere in it.

Of no less interest is the following extract from an article by Col. William L. Black, of Fort McKavett, Tex., who writes from an experience of many years:

> The brush question is a most serious one in a great many of our States. So long as land can be kept under cultivation the brush can be kept down; but when it is once thrown open to pasture briers and brush of all descriptions begin to grow and soon cover the entire surface. Even in our own State of Texas many millions of acres are growing up into brush thickets and will sooner or later become worthless for pasturing cattle, and in many of the Western Territories the same conditions exist. It is supposed that this has been produced by an increase in the rainfall, but I am inclined to think it is not altogether due to this fact. That brush and trees are indigenous to many of our so-called arid districts can be very easily proven by the great quantities of roots that the present inhabitants dig out of the ground for fuel purposes. Not a tree can be seen for hundreds of miles, yet these great roots can be found almost everywhere on the prairies and are a substantial witness to the fact that there was an abundance of trees there at some time or other. Before this portion of the United States was occupied by the white man it was a common practice of the Indians to burn the high prairie grass every fall or winter in order to hunt wild game that was so abundant in this part of the country. Buffalo and deer were as common then as cattle and sheep are now, but the grass was so high in places they could not be seen, and the Indian would burn it off to be able to hunt them more readily. This undoubtedly destroyed much of the growth of trees and, in my opinion, is the true explanation of the roots that are now found in many parts of west Texas, New Mexico, and other Western Territories.
>
> The question is a very important one; and if the goat can be used to keep this growth back, it is certainly well worth the attention of many of our landowners, who may, in a few years, find their land practically worthless. A personal friend writes me that "many pastures are growing up to oak brush and hazel brush in the North, and in New England they are bothered with ferns (called brakes), berry bushes—blackberries, raspberries, etc." This kind of fare would be "peaches and cream" to a goat, and in a year or two the owner would be relieved of a great nuisance, the goats would grow fat, and the land would be restored to a proper condition for grazing other stock on it. Another correspondent in Massachusetts speaks of a certain small island he owned which was so densely covered with brush as to be utterly valueless except to grow mosquitoes. I hear of many parts of the East that are seriously troubled with brush, where many thousands of acres are of no use for grazing purposes, and the profit in farming will not justify the cost of grubbing it. In the Southern States many farms have become worn out and are growing up into brush and weeds. The Angora goat is the proper animal to employ to put these lands in a condition either for cultivation or grazing cattle. But a number of my correspondents have asked me what they could do with the goats after they had cleared the land. In reply to this I will say they can well afford to slaughter them and feed them to hogs, but this is not necessary now. The fashion has changed since I slaughtered goats for their hide and tallow, and there is no trouble in selling all the goats you send to any of our large meat-packing markets.

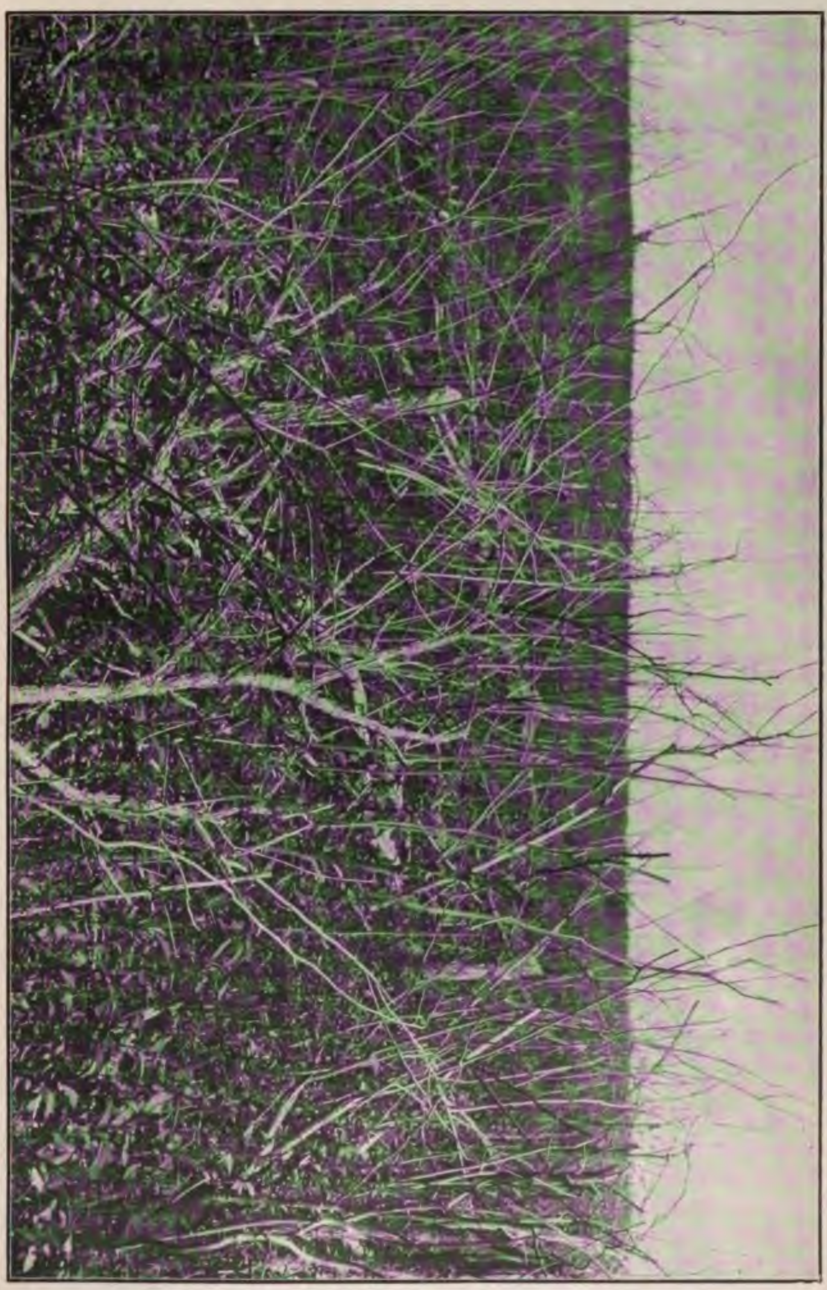
Mr. E. H. Jobson, having in mind the markets as well as the clearing of land, writes as follows:

> The best and most effective way to clear brush land with Angora goats is as follows: It will not be necessary to put up a very high fence; 4 feet of close fencing is plenty and will be sufficient to keep the goats in. The proportion of goats is two and one-half to three goats to an acre of ordinary thick brush land. I believe the cheapest way to clear your land is with yearling wethers, as will be seen later on. If wethers



BRUSH LAND "BEFORE GOATING."

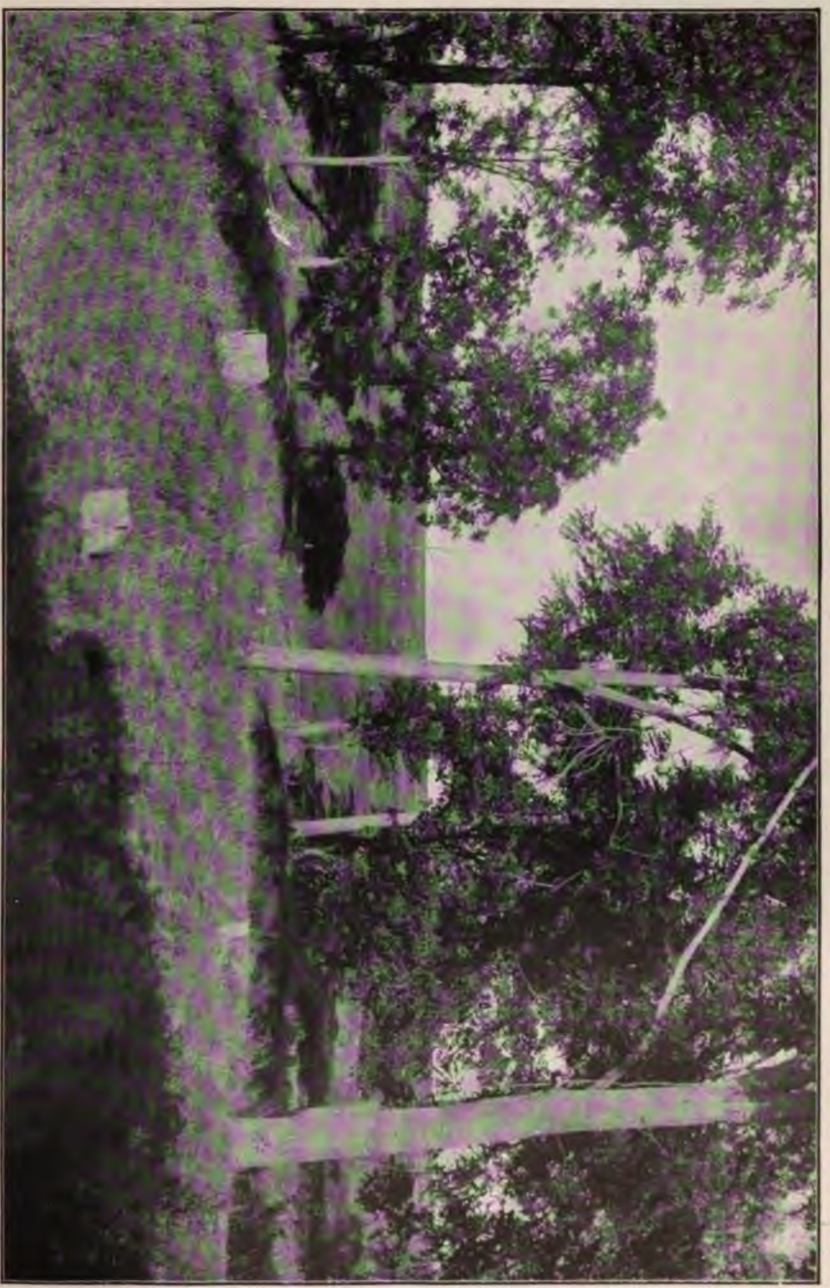
(Photograph furnished by Dr. J. R. Standley, Platteville, Iowa.)



BRUSH LAND "DURING GOATING," AFTER TWELVE MONTHS.

(Photograph furnished by Dr. J. R. Standley, Platteville, Iowa.)

PLATE LX.



BRUSH LAND "AFTER GOATING" TWO YEARS.

are used, you must fence off one-third of the land you desire cleared, so the goats can not get to it. The proper time of the year to turn them loose on the brush is after the spring rains have ceased, whish is usually about the 1st of June. By this time the leaves will be well matured, and the goats immediately proceed to strip the brush of its foliage, which leaves the stems and branches exposed to the hot sun, which cooks them and kills the brush from its deepest roots to its topmost branches. The hot sun being the most effective, and there being no rains to revive the sap, it makes quick destruction of the brush. By the time that the goats will have the largest portion of the land cleared it will be well along in August, and it will now be time to turn them in on the piece of land fenced off at the start, which is fresh and abundant. In connection with the brush feed allow them one ear of corn a day, and at the end of six weeks they will have cleared the remainder of your brush land, and the corn you have been feeding them will have them in prime condition to be thrown on the market, where they will bring as much as, if not more than, you paid for them. The result is that you have cleared your land, at most, at an actual cost of 50 cents an acre, and besides that, your land is now ready to set in blue grass, which will enable you to rent it to sheep growers at $2.50 per acre, thereby causing the idle land to produce an income rather than a constant incumbrance of taxes, with no profit at all.

An illustration of the value of Angora goats in clearing land is given by Mr. Abe Blackburn, of North Yamhill, Oreg., who says that he now has a pasture that will keep 200 sheep which did not have grass enough to keep a goose when he turned his goats into it a few years ago. The goats have killed out the brush, and the grass has taken its place.

The following quotations from others who have had experience with goats as brush destroyers show how well the work is done, and, to some extent, the character and kinds of brush eaten:

When confined in small bushy pastures they have been profitable in clearing the land. Some of the finest vineyard lands in California have been cleared by goats. A farmer in western Oregon, who has for several years run a small flock of goats in a pasture with dairy cows, says the pasture now produces double the grass it did before he purchased the goats. Lands formerly producing nothing but brush and ferns are now covered with clover and bunch grass. A farmer in Iowa writes as follows: "Their value as brush-land cleaners can hardly be estimated. To a person who has never seen the results of the application of Angoras to brush lands, a ride through my blue-grass pastures is a revelation. Where three years ago the ground was densely covered with an undergrowth of hazel, crab tree, oak, blackberry, and other brush, it is now growing the finest blue grass. At present I have over 600 acres which have been reclaimed, and a conservative estimate would be that the value of the land had thereby been enhanced at least $10 an acre."—*C. P. Bailey, San Jose, Cal.*

Angora goats like a variety of food; they live principally on leaves and young and tender barks and twigs of bushes and small trees, but, if necessity compels them, they will also eat weeds and grasses, and for a time do well on them. The quality of a goat pasture, therefore, depends upon the amount and variety of brush, especially evergreens—as cedar, hemlock, live oak, holly, etc.—which it contains, for on these, as well as the tender bark and twigs of all kinds of bushes, they live principally in winter; and the more of it they find the less grain and hay do they require during the cold spells.—*G. A. Hoerle, Ridgewood, N. J.*

For clearing out thickets and undergrowth of all kinds there is nothing better than these goats. Their pasture will soon look as clear as a cleaned-up picnic ground as high as they can reach when standing on their hind legs. In this way they can reach 5 or 6 feet high, and they bend down everything they can reach with their fore legs. The brushier the range the better, and the more different kinds of brush and weeds on their range the better they will thrive.—*H. T. Fuchs, Tiger Mills, Tex.*

They more than pay for the expense of keeping them by clearing my land. They clear off the willows, haws, buck brush, and squawberries and leave a good bluegrass pasture where there was a nuisance in the first place.—*J. D. Lewis, Colo.*

He will eat buck brush, black oak, hickory, and all other kinds of brush, jimson weed, ironweed, smartweed, and every other weed that grows, leaving the grass for other animals that will feed after the goats.—*R. C. Johnston, Lawrence, Kans.*

There is good grass here (Wyoming), but my goats won't eat buffalo grass. They will browse on sagebrush, grease wood, scrub cedar, scrub pine, laurel, and willows; but they refuse to eat the best grass that grows.—*W. W. Eheler.*

In Arizona the principal and favorite browsing is live-oak brush.—*J. F. Holder, Ariz.*

The statement is made in a previous paragraph that goats are omnivorous eaters, apparently preferring those kinds of vegetation that other animals do not eat. The information in the quotations just given indicates that they will feed upon a great variety of plants. With the object in view of ascertaining the different kinds of plants that these goats feed upon, the Bureau requested several stock raisers in various States and Territories in the country to report answers to the question, "What kind of browse do your goats have?" Some information of this character is in the quotations above and more will be found in the replies copied below, credit for the statements being given to the State only:

All kinds of bushes, such as scrub oak, cedar, etc., in Texas. In this part of New Jersey most everything that exists in Texas, except scrub oak and live oak, may be found.—*New Jersey.*

Black oak, sumac, buck bushes, briers, and all kinds of weeds. They will not eat grass if they can get browse.—*Missouri.*

Buck bush, elders, sumac, prickly ash, briers, grapevines, jack oak, ash, sycamore, basswood, and hickory. The latter they do not seem to care much for.—*Kansas.*

Brush, weeds, and grass.—*Texas.*

In southern New Mexico they have live oak and mahagony. They do best on scrub oak.—*New Mexico.*

Oak, hazel, vine maple, ash, willow, rosebush, thimbleberry, blackberry, buck bush, service berry, crab apple, haw berry, soft maple, and some fir.—*Oregon.*

Mostly mountain oak and other classes of underbrush. They will not eat grass if brush is obtainable.—*New Mexico.*

Oak and hazel.—*Oregon.*

Maple, hazel, willow, fir, thimbleberry, cascara, vine maple, cherry, alder, and salol.—*Oregon.*

Willow, ash, and buck bush on low, swampy land in summer time, and straw and fir brush in winter months.—*Oregon.*

Apple, fir, oak, ash, willow, maple, and poplar.—*Oregon.*

We have almost all kinds of browse in Arizona, but scrub evergreen oak predominates. We have millions of acres of it, too.—*Arizona.*

Oak, hazel, ash, fir, and madrona.—*Oregon.*

Live oak, post oak, hackberry, elm, black persimmon, black jack, mesquit, mountain cedar, wild plum, etc.—*Texas.*

Several kinds of oak, sumac, grass, and weeds. They will eat almost any kind of underbrush.—*Texas.*

Brush, weeds, briers, mullen, and thistles.—*Iowa.*

All of the undergrowth common to southern Iowa—plum, hazel, four or five kinds of oak, elm, three or four kinds of willow, crab apple, and buck bush (sometimes called turkey berry).—*Iowa.*

Browsing supplements feeding.—The browsing habits of goats is important in connection with the question of feeding. In some places they obtain enough browse to carry them through the winter. This is especially true in the Southwest, where there is so great an abundance of live oak. If snow is on the ground, or for other reasons the goats are deprived of opportunities for foraging, the trees are cut down for them. They pass though the winter in good condition with other feed. Wherever they are deprived of opportunities for browsing, they must be fed. Browsing saves feed. As far north as Nevada Mr. Bailey's goats subsist the winter through on sagebrush.

Browsing adds game flavor.—It is noted that many of the correspondents heretofore quoted state that it is the browsing of the Angora that gives to the meat the game flavor, thus leading some to name the meat "Angora venison." It is also stated that when deprived of browse and fed on grass and grain the game flavor disappears. There is no reason why this should not be true, for it is a well-known fact that flavor may not only be fed into meat, but into milk and eggs as well.

Common goats as brush destroyers.—The fact must not be overlooked that the brush-destroying habit is common to all kinds of goats. The common goats will do the work as well as the Angoras. The latter are employed for the purpose because they are more plentiful and because there is profit in their progeny for breeding purposes, their mohair, and their meat.

Preserving brush land for browsing.—Up to this point consideration has been given to these goats as a means of clearing land for pasture or for cultivation. There is much brush land in the United States which will support goats but is good for nothing else. If this is to be devoted to goat raising, it is, of course, not desirable that the brush be entirely exterminated. In this event a goat raiser should have several fenced areas and change the goats from one to the other frequently. They should not be permitted entirely to denude one field before they are transferred to another. It is true, however, that no matter how perfectly a woodland may be cleared of brush it will be covered over again with briers and brush in a few years if constant attention is not given it. It is not difficult to overpasture such land, and if the goats adopt the "peeling" practice the brush and trees will have greater difficulty in recovering.

Grass and weeds as pasturage.—Considerable interest has been manifested in the Angora industry in those localities where browse is not available and where grass and weeds form the only pasturage. A great many inquiries of this character have come to the Bureau, and the Bureau, in turn, has referred the matter to the breeders of the country. The replies received have been numerous, and show a difference of opinion. The predominant opinion, however, seems to be that the goats thrive best under the conditions most nearly like those of their original home. It is certainly the best argument to say that goats prefer any kind of browse to the most nutritious of grasses, which is true, and therefore browse is better for them than grass. While the more economical conditions obtain where there is an abundance of browse, it is not definitely settled that the goats will not thrive well on common pasture grasses. It is the opinion of the writer that this question is still an open one, as some successful breeders have had goats on the grass range for thirty years. From the standpoint of the goat's preference, there is no question that browse is the better food, and this in itself is a forceful argument.

There is always expense in connection with pasture grasses, but there is little or none with browse. One of the chief reasons why goats are receiving so much consideration at this time is that they are practically inexpensive feeders, and so all items of expense must be figured on if profit is to result. Pasturage, unlike browse, is not available all the year through. Therefore in prairie locations feeding in winter is a necessity. One of the recommendations in favor of Angora mutton is that it has the flavor of venison. This flavor is imparted by the browse, and is absent in the mutton made from grass or grain feed. Many claim that the animals make a better growth among the bushes than on open pastures, and that the quality of the fleece is much better. Contrary to this, however, is the opinion of Mr. Philo Ogden, of California, who says: "The fact is that the brush disappears from my range and the fleeces become heavier, with less wax or gum, and has more luster. Further, 75 per cent of the young stock are larger than their parents and shear more and finer hair." He says, also, that his experience in raising Jersey cattle was similar, in the respect that as they were taken out of brush pasturage and grown on grass pasturage they obtained a larger frame, so much so that sales failed because of a suspicion that they were not purebred.

Opinions of several correspondents of the Bureau are given in the paragraphs following:

It is not advisable to raise goats for their mohair on farms on which they will be obliged to feed to a large extent on grass and forage plants which are suitable for sheep.—*H. M. Williamson, Portland, Oreg.*

My experience is that on plains, and with grass as the only food, thoroughbreds would not do well, while the lower grades may do fairly well so long as the altitude is sufficient. Usually the mohair is somewhat dry and coarse where grass is predominant.—*G. A. Hoerle, Ridgewood, N. J.*

Where there is grass and brush, they leave the grass and eat the brush. They prefer browsing.—*Cook & Buck, Oskaloosa, Kans.*

Brush and weeds are the proper feed for goats, but they will do fairly well on grass alone.—*Harris & Baylor, Montell, Tex.*

They must have some brush.—*U. S. Grant, Dallas, Oreg.*

Experience has proven that they will do as well on prairie farms as on any other place, but they should have artificial shade for hot weather.—*E. H. Jobson, Lake Valley, N. Mex.*

High-bred stock will do specially well.—*V. Cladek, Larwood, Oreg.*

They will do well anywhere that they can get green food.—*Abe Blackburn, North Yamhill, Oreg.*

Angoras will do well on prairie farms if they are changed into different fields often or have a large pasture.—*Oscar Tom, Angora, Oreg.*

They do well on prairie farms, but do better on bushy or hilly land. One of the advantages of Angoras is their adaptability to rugged bush land which is unfit for other stock.—*C. P. Bailey, San Jose, Cal.*

Angoras will do well on grass and weeds, but will do much better if they can get considerable browse also.—*Josephus R. Barnette, Globe, Ariz.*

Only in small numbers will they do well on grass and weeds, but where they are kept in large numbers they need a good deal of brush and timbered country. Of course, they will do well on prairie if they get some corn.—*H. T. Fuchs, Tiger Mill, Tex.*

They will do first-rate on prairies, where grass and weeds are the only pasturage; but they will then have to eat the feed which the other stock require, whereas, on brush ranges the capacity of the land for carrying sheep and other grass-eating stock is not lessened by the presence of Angoras.—*W. G. Hughes & Co., Hastings, Tex.*

I pastured two summers on grass and clover, and they did as well as when on leaves and weeds. I am confident that a farm cleared of brush can successfully be used for Angoras.—*J. R. Standley, Platteville, Iowa.*

They need a great variety of feed and rough range, with plenty of pure, clear water.—*W. T. McIntire, Kansas City, Mo.*

They do well while the grass is green, but do not like dry grass or weeds, and always do better when they get some brush. They will have to be fed in winter on prairie farms.—*H. I. Kimball, Maxwell City, N. Mex.*

Pasturing with other stock.—So far as the goats themselves are concerned, they may be kept in the pastures where there are sheep, cattle, and horses. Their presence is in no way obnoxious to any of these animals. It has already been pointed out that a few of them in a flock of sheep are a protection against dogs. However, it is not best for the goats that they be kept in pastures with horses. This is especially important if there are kids, as the horses have a habit of playfully chasing any animal that is not large enough to defend itself, and they are apt to strike the kids. It is also important that the kids should not be in pasture with hogs, which are liable to eat them.

Number of goats to an acre.—This is a question frequently asked, but certainly no thoughtful person expects a definite answer. The number will depend, first, upon the object in pasturing on brush land, whether it is to kill the brush or to use it as a permanent pasture; and second, upon the quantity of feed obtainable. While one acre might be as dense as a jungle, another might have small thickets alternating with grass plats. Thus it will be seen that a definite answer can not be given to this question.

MOHAIR.

Quality of the fiber.—The word "mohair" is the technical name for the fiber of the Angora goat which is used in the manufacture of fabrics. The word comes to us, through the old French "mohere," from the Arabic "mukhayyar," meaning mohair cloth.

Besides the mohair there grows upon the Angora goat a short, stiff hair, which is technically known as "kemp"—a subject that will be discussed in another paragraph. It is held by some writers that this short hair does not occur on the pure Angora, and that where it does appear it is upon Angoras that have been bred up by crossing upon the common goats; in short, that it is a relic of the common goat. This argument seems plausible, at least, for two reasons: First, there is no certainty that any Angora goats now in existence are absolutely purebred, as many years ago the Turkish breeders began the practice of crossing upon the Kurd goats, and thus vitiating the blood; second, it is noticeable in building up a flock by crossing upon the common goats that the short hair is very prominent in the first cross, and gradually grows less as the crosses become higher.

The uses of mohair in manufactures are discussed on page 44 and need not be repeated here. The properties of this fiber which render it desirable are length, fineness, luster, strength, elasticity, and specific gravity, and these are relatively desirable in about the order given. There is no difficulty in securing length and strength, but the other properties must come by the most painstaking care by breeding. Having length, strength, and luster, the manufacturer wants the fiber as fine as can be bred. Good mohair averages about one five-thousandth of an inch in diameter; or, expressed otherwise, 5,000 hairs may be laid side by side in solid contact within the space of 1 inch.

Many mohair growers assert that the quality of the fiber depends largely upon the climate and the feed; and all are agreed that the fiber becomes coarser as the animal grows older. Schreiner says:

> If goats are to produce the best fleeces they are capable of, they must be maintained in uninterrupted good condition. They must have a variety of food, principally shrubs and aromatic plants, and lead an active life; they must, if possible, have running water to drink and be kept free from dust; they must not be kraaled (or shedded) except when absolutely necessary; they must have clean sleeping places and must not be crowded together.

The wide range of prices of mohair in the market is due to various causes, but to none so much as the unevenness in quality of fibers. As compared to the total production in the United States, the quantity of first-class mohair is exceedingly small. The tendency has been to breed for length of fleece and size of animal. While both these qualities are desirable, it ought to be plain to anyone that profit does not lie in these directions wholly.

Mohair in a general sense is an expansive term, covering the fleeces of goats of various Angora crosses. The fleece from a cross between an Angora buck and the common "nannie," although scant, coarse, and of uneven length, is unfortunately called mohair, just the same as that from the best animal. The fleece of the second cross is better, and that of the fourth and fifth crosses very good, provided, always, that first-class bucks have been used. The complaint of the manufacturers is that very little first-class mohair is produced in the United States. It has been demonstrated, however, that a first-class fiber can be produced here. Mr. Meeker, late consul at Bradford, England, the leading mohair market of the world, recently wrote as follows:

> There has been on exhibition at this consulate for the past week an American-grown mohair fleece forwarded to Bradford by Mr. C. P. Bailey, of San Jose, Cal. The fleece is that of a 2-year-old graded doe and is understood to have been grown on Mr. Bailey's ranch in Nevada. The quality of the hair has been the wonder of all who have seen it. It has been closely examined by several of the leading mohair dealers and importers, all of whom have expressed the highest opinion of it. One of them, Jonas Whitley, ex-mayor of Bradford, said: "I have now in my warehouse about $200,000 worth of mohair, both Turkey and Cape, and I am entirely sincere when I state that there is not a better fleece in the lot. I will buy all the American mohair like that that may be offered me at the market price. Should it uniformly equal this fleece, I do not know but what I would pay more than the market price. * * * I unhesitatingly say that the sample fleece is as good mohair as is grown."

A well-known spinner of New England is quoted by Mr. Bailey as saying that—

> The American mohair is better than any brought from abroad; it is smoother, makes a smoother thread, and runs spindles faster; it is silkier and softer, and I can pick out cloth made from it without looking.

Mr. G. A. Hoerle says:

> Samples of our best mohair which were sent to England were classed as equal to the best Turkish, while the best Cape hair was as much as 2 or 3 cents lower, a fact which proves that even if we finally should have to ship mohair to Europe it would, in the long run, pay as well as selling at home.

Those American breeders who have been taught to believe that the mohair of the Cape of Good Hope is so much better than that produced here will find encouragement in the following from Mr. S. B. Hollings, writing to the Midland News, Bradford, England, under date of April 27, 1900:

> When I state that the vast majority of mohair clips produced in Cape Colony does not fill the bill of our manufacturers I state the whole and sole reason why Turkish

sorts have been called upon very extensively in preference to that grown in South Africa. * * * I am stating a plain fact that Bradford users do not think that the Cape clip is as yet within 25 per cent of the general excellence of that grown in Asia Minor, and that much remains to be done before users here will avail themselves of that produced in Cape Colony in preference to that grown in Turkey.

The encouragement is not in the fact that the Cape mohair is so much poorer than the Turkish product, but because ours is no worse than that of the Cape. Although the annual product of the Cape of Good Hope is about 12,000,000 pounds and ours only 1,000,000 pounds approximately, the growers there recognize the importance of the American industry. Mr. W. Hammond Tooke, after discussing the Australian possibilities in this industry, says "the United States of America should give us more concern." In the same article, published in the Agricultural Journal of the Cape (May 25, 1899), he states that the breeding of goats here for mohair is no longer considered an experiment, and that the mohair is "much like a large part of that produced in the Cape, consisting of rather low grades, short and crossbred, and only suitable for combination yarns and for mixing with Turkey hair."

As illustrative of the superior value of the mohair from Angora vilayet and Cape of Good Hope, the following table and statement are copied from Schreiner's work (p. 44). The figures represent the average of the four years 1891 to 1894:

	Angora.	Cape.
Mohair goats.....number..	1,230,000	2,891,233
Mohair.....pounds..	3,960,000	9,982,709
Per goat.....pound..	2¾	[a]3½
Total value of mohair.....pounds sterling..	200,000	419,501
Per pound.....	1s. 2¼d.	[a]10 1/11d.
Money yield of mohair per goat.....	3s. 3⅛d.	2s. 11⅛d.

[a] Nearly.

The superiority of the Turkish hair is at once apparent, there being a difference in its favor in the above figures of nearly 4d. per pound, and also a difference in its favor in the net return per goat of nearly 4d., although the Turkish goats shear three-fourths of a pound of mohair less per goat than the Cape goats.

Mr. George B. Goodall, of the Sanford Mills, Sanford, Me., points out, in a recent letter to the Bureau, the defects of the American-grown mohair taken as a whole. His mills consume more than a million pounds of mohair annually, some being the domestic product and some the Turkey product, and thus he speaks from large experience. He says:

Before the domestic mohair growers can expect to get anywhere near Turkey prices they must do away with kemp and aim for a fine stapled hair instead of breeding for coarse, heavy fleeces, as many do. The coarser the fiber, the lower the value to the spinner. We often get small shipments of domestic fleeces as choice and fine as

> those grown in Turkey, which goes to show what can be accomplished with care and brains. The trouble is more with the grower than with the goats and the climate, for what one man can do another can do.

There are in these quotations hints enough to point the proper course for those goat raisers who desire to make their mohair crop a paying one. If an Angora goat is of most profit in clearing land of brush (as is the case in some localities), his work will be done just as well if he produces at the same time a first-class fleece; thus he may become more valuable. There is no reason why Angoras should have the preference for such work over the common goats, except that they may be profitable in other respects at the same time; therefore the better the fleece produced while destroying brush, the greater the value of the goats.

Influence of age and blood on fiber.—Reference has already been made to the fact that the fiber becomes coarser as the animal grows older. The fiber is also coarse upon younger animals of the lower crosses. The best fiber grows upon the animals of best blood; and among these that upon kids, yearling wethers, and does, in the order named, is preferred. The best fiber is usually very curly, in ringlets rather, but not kinky. It loses its curl and becomes thinner on the goat, coarser, and straighter as the animal grows older. A fiber of best quality is shown on the left of Plate V. It will be noticed by careful examination of this illustration that the samples become less curly as arranged from left to right. The reason for this is that the samples are coarser toward the right. The last sample in the illustration is from an old buck, the one next to it from an old doe, while the two samples on the left are from kids.

The weight and length of fleece.—The weight of the fleece is always a subject of inquiry and is a difficult question to answer, because of the controlling circumstances—such as climate, feed, care, and, above all, the degree of Angora blood in the animal. The briefest answer, and probably the best one that can be made in a general way, is that of Mr. C. P. Bailey, and is as follows:

> Half-breed goats scarcely shear enough to pay for the shearing; three-fourths bred goats shear 1 to 1½ pounds, worth 15 to 20 cents; seven-eighths bred goats shear 2 to 3 pounds, worth 20 to 30 cents; fifteen-sixteenths bred goats shear 3 to 5 pounds, worth 30 to 40 cents.

He adds the important statement that the fourth cross, or fifteen-sixteenths, is the lowest grade that he would use exclusively for mohair.

It would be a difficult matter to state what is the average length of an annual fleece, but 10 inches would probably not be much out of the way. There is on record an account of mohair measuring 20 inches. Mr. U. S. Grant, of Oregon, reports a buck with a fleece 19 inches long. In the southern part of the country, where shearing is done twice a year, the fiber must necessarily be shorter. This is a disadvantage, as the spinners prefer a long fiber. Schreiner shows (p. 119) a picture of a buck carrying a 13-months' fleece, weighing 16 pounds, which touches the ground. The feet of the animal are just visible.

The weights of the fleeces in the United States are much greater than in Turkey and about the same as in the Cape of Good Hope. With reference to Turkey, Schreiner says: "It would seem that 14 pounds for rams and 8½ pounds for ewes are about the maximum weights of really first-class fleeces, and that if these weights are much exceeded the quality of the hair is inferior and a good deal of the weight is due to oil and dirt." In the Cape of Good Hope buck fleeces have surpassed 15 pounds and ewe fleeces 11 pounds. Information at hand indicates that the average weights of fleeces in Oregon exceed those of other sections of the country, especially in the warmer portions. This reminds one of the opinion of Colonel Black, that the fleece will be increased 1 pound in weight by moving the goats to the colder Northern States.

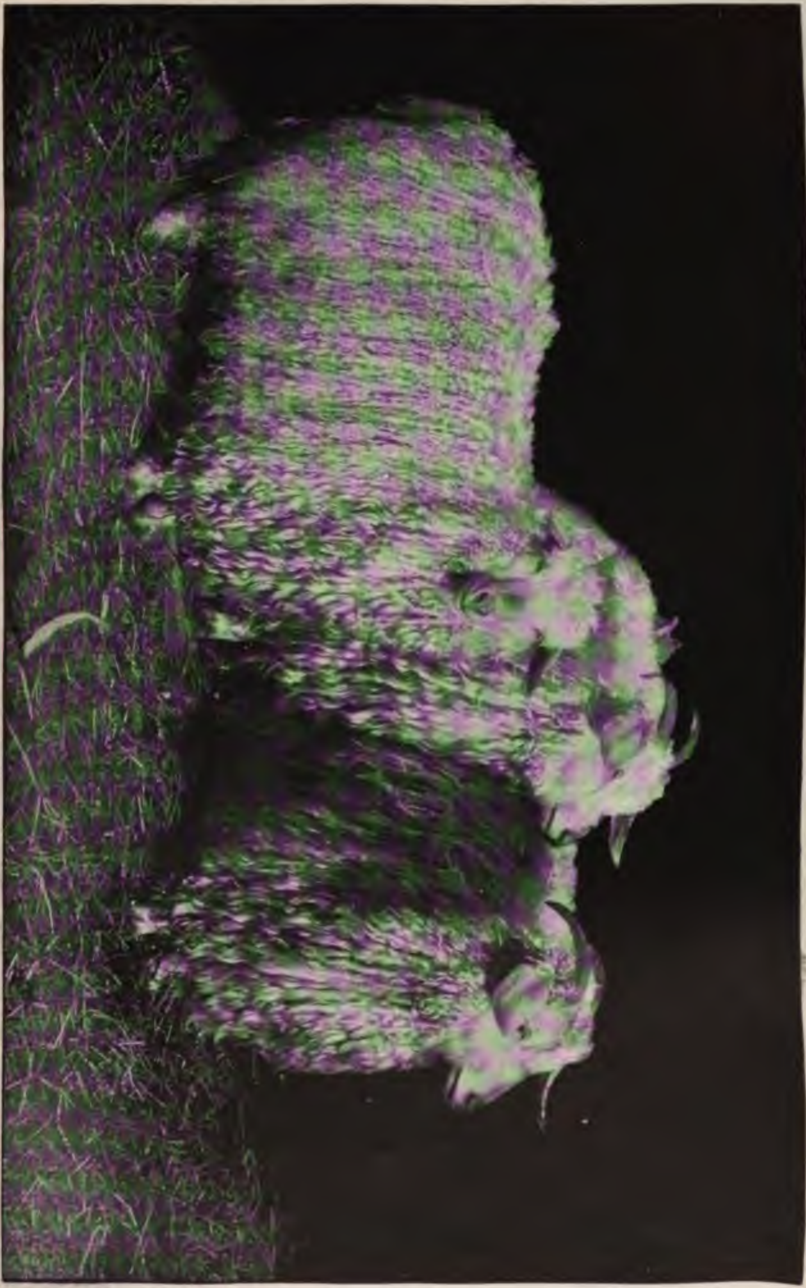
Schreiner says that the goats must not be crowded together in quarters if the best fiber is to be obtained, and Hoerle says that "goats running together in small herds will shear from 25 to 40 per cent more than when running in large herds." The size of flocks is discussed in another place (see p. 000).

The influence of semiannual shearing upon weight of fleece is also discussed elsewhere (see p. 000).

Kemp.—The term "kemp" used in connection with mohair refers, in a collective sense, to the coarse hair of the goats, and is especially noticeable in the lower grades. Hoerle says: "Kemp is the coarse, dead-looking hair all through the mohair, about 2 to 4 inches long, which I consider to be the degenerated remnants of the long, coarse, dead-looking outer coat of some common goats. It is usually thickest on the hind quarters of badly bred goats." Its presence in mohair always reduces the price in proportion to the amount that is present. The reasons for this are various—the hair is coarser than the mohair; it is lusterless; it is of various short lengths and must be removed, in doing which there is a heavy loss of mohair; and it will not, except to a limited degree, take the dyes used for mohair. This last statement is a striking fact and ought to be the means of prompting the mohair growers to strive to breed it out. Whether or not it can be done entirely is an open question, but it is believed by many prominent breeders that it can be done. Schreiner, however, considers kemp a part of the fleece that can not be eradicated completely.

C. P. Bailey & Sons Company say:

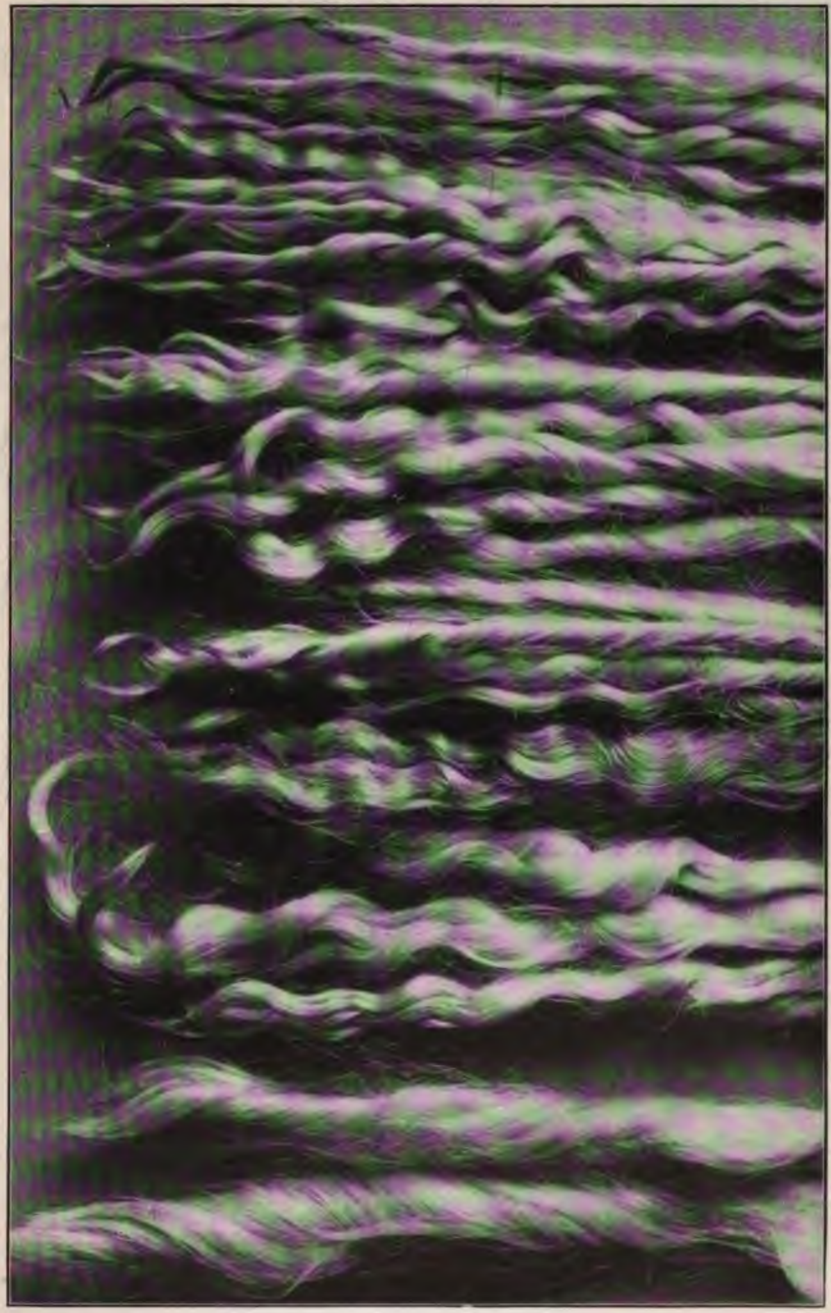
> Kemp is a coarse white hair which grows from a separate root sheath between the mohair and is usually thickest upon low-grade goats. It is most noticeable along the backbone and around the tail and upon the thighs. We have never seen a goat entirely free from kemp, nor have we ever seen mohair from any part of the world



DOES, TWENTY-ONE MONTHS OLD. FLEECE OF NINE MONTHS' GROWTH.

(Photograph furnished by Dr. J. R. Standley, Platteville, Iowa.)

PLATE LXII.



SAMPLES OF MOHAIR.

(Samples furnished by Harris & Baylor, Montell, Tex.)

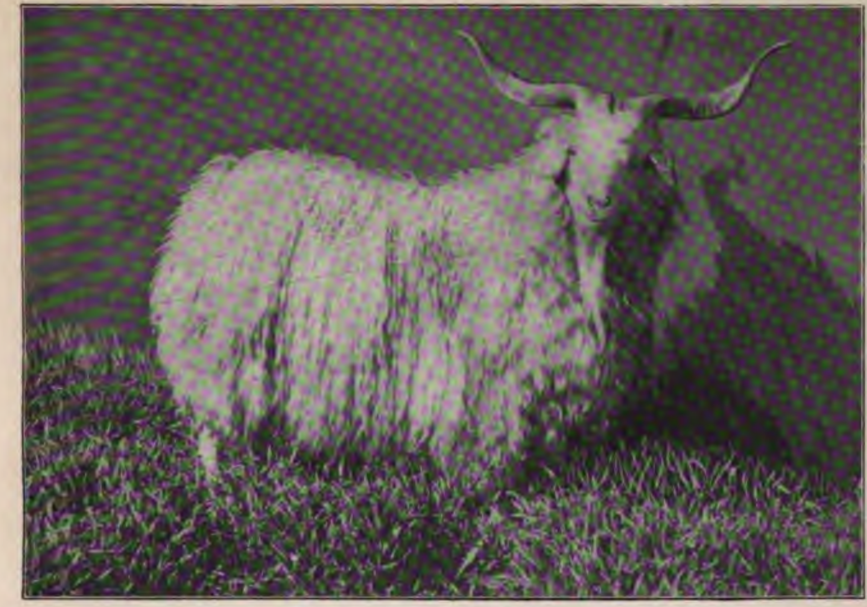


FIG. 1.—ANGORA BUCK "PASHA"

(Photograph furnished by C. P. Bailey & Sons Company, San Jose, Cal.)

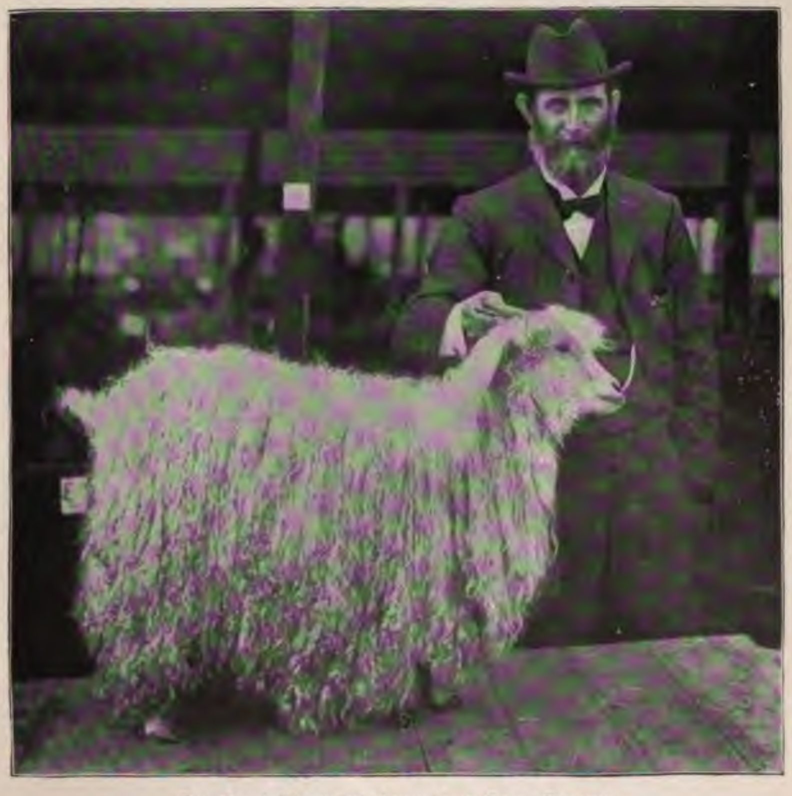
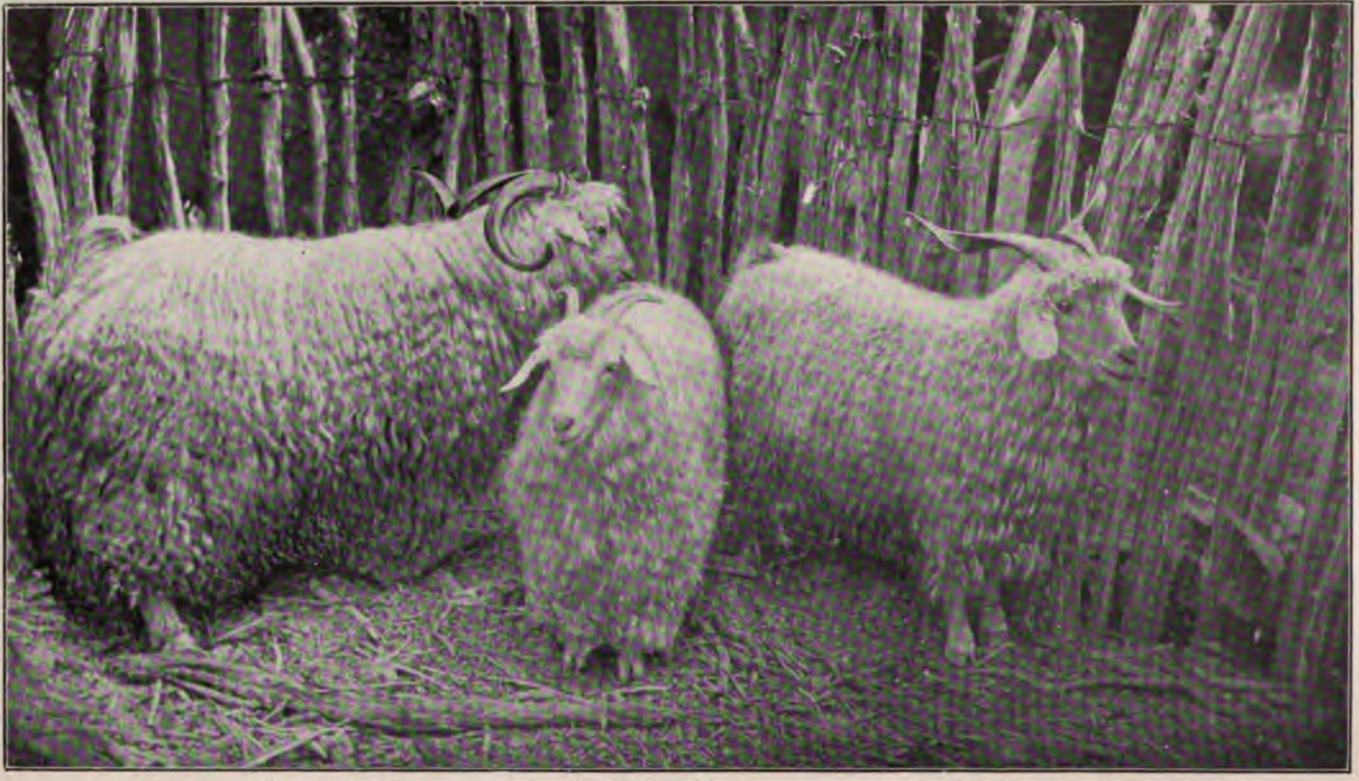


FIG. 2.—A YEARLING ANGORA IN CAPE COLONY.



Fleece, 9 pounds. Fleece, 5¼ pounds. Fleece, 6 pounds.

ANGORAS, SHOWING FLEECES OF SEVEN MONTHS' GROWTH.

(Photograph furnished by Harris & Baylor, Montell, Tex.)

that was entirely free from it. Kemp may be best detected by separating the mohair upon the thigh of the animal and closely inspecting the roots of the hair. It will be seen as short, coarse, lusterless fibers closely intermingled with the long, silky mohair.

After the mohair sorter has done his work with a fleece the fiber is scoured, dried, and straightened, and then put upon a combing machine. This machine separates all fibers, whether of kemp or mohair, of 4 inches in length and under. Kemp of a greater length than 4 inches remains with the longer mohair. If there is much of this long kemp after the first combing, the fiber passes through a second combing, the machine being set to throw out the kemp and mohair of greater length.

The residue of these two combings, being a mixture of kemp and short mohair, is called noilage. The first lot of noils is about 2 inches long and the second 4 or more inches long. The length of the second noils will vary with different grades of mohair, depending upon the length of the kemp present.

Some mohair will shrink 40 per cent in weight in the first combing and 15 per cent in the second. The mohair thus combed is used in the fabrication of plushes and fine dress goods, while the noils go into the manufacture of carpets, blankets, hats, etc.

In a recent article in the Oregon Agriculturist, Mr. George B. Goodall says:

> A majority of the mohair growers in this country little realize how much kemp has to do in keeping down values of their clips. If they could spend a few hours in our sorting and combing rooms the lesson learned would be of great value to them—more than could be obtained by reading. In watching the combs at work they would notice some making 5, 10, or 12 per cent of noil or waste, while others will be taking out 30 or 40 per cent. Ask the comber the reason of this and he will reply that one lot has a much larger amount of kemp than the other. One fiber of kemp takes out five or six good fibers which should go into yarn. It may not generally be known why kemp is such an objection, but when we state that it will not take color, but remains nearly white in the goods after passing through the dye bath, you will understand why I write so strongly on this point. If you want to form some idea of how a fabric looks made from kempy mohair yarn, just look at a man's hair that has commenced to turn gray, especially dark or black hair.

Through the kindness of Mr. Goodall the Bureau of Animal Industry has received some samples of low-grade plushes for car seats which show the effects of kemp in mohair. Although in this case dyes were used which acted to some extent upon the kemp, the coarse, dull-colored hairs are easily seen. An effort was made to photograph the samples for reproduction in this paper, but it was impossible to bring out the details sufficient to show the kemp, although it was plainly visible, under certain lights, in the plushes.

The following is taken from Mr. E. H. Jobson's Angora Goat Raising:

> In the first crossing of goats the kemp hair will be paramount in appearance with the mohair and will be very coarse, and as the animal becomes better graded the shorter the kemp will be, and it also generally becomes of a finer fiber as the pure

blood is infused. Upon examining the best grade of goats that we have we find that the kemp is very short, probably only three-fourths of an inch in length, and the mohair on one of these goats is 8 inches long and weighs 5 pounds, while the kemp on the second goat is just as scarce and of the same length; also the mohair is of the same length, but the weight is fully 2 pounds more than it was on the first goat: herein lies the difficulty. Both goats have the same appearance so far as examination can determine, but the second goat is inferior to the first because the fiber of his hair is much coarser than the other and contains more of the kempy blood; hence the difficulty in examination appears in the quality of the fiber, which can be detected only by an experienced eye.

The kemp hair will always be known by its being shorter and very coarse and of a chalky-white appearance. It is particularly noticeable on account of its having no luster, which is characteristic of all mohair. The first place that kemp becomes extinct on a goat is on shoulders and neck—i. e., on the sides and along the ribs—and the last place for it to become extinct is along the top of the neck, down the backbone, and on down to the hocks, the hocks being generally the final place for the disappearance of the coarse hair; also you will find kemp to predominate on the belly. Do not understand me to say that the kemp becomes entirely extinct, for it does not, but it is covered up with the mohair and can be seen only by throwing the animal down and examining him carefully, and if he is apparently free from kemp you can examine him on the places above mentioned and you will invariably find more or less kemp, and generally you will find considerable all over the body. A good way to examine the hair is to pull out a small lock and spread it out in the hand, and you can readily discern any coarse hairs that may be in it. It is supposed by the best authorities we have that there are no goats in the world that are absolutely free from kemp, although it is confidently expected by many of the prominent breeders that it is only a question of a few years more of careful breeding until we have a kempless goat.

In addition to the above, Mr. Jobson writes to the Bureau his opinion that there have not yet been produced any goats absolutely free from kemp, but he believes that the intelligence of the Americans will enable them to produce such goats, and he himself proposes to devote several years to the effort. He proposes to begin this work upon the assumption that there is nowhere an absolutely pure Angora goat—that there is at present in all of them in some degree the blood of the common breed.

The discussion of kemp will close with quotations of the opinions of correspondents of the Bureau who have had experience in raising Angoras. It may be stated that a large majority of these men hold that kemp never disappears entirely. The quotations follow:

I don't think that there are 500 Angoras in the United States, thoroughbreds or crossbreds, that are entirely free from kemp. Judging, however, from what I have seen in former years, freedom from kemp can exist, even with second and third crosses, provided the right kind of common does are mated with really kempless bucks. Such experiments were made with bucks of the Price Maurice importations to Australia, of which one buck and two does came to Texas. Mr. Schreiner, the Cape Colony authority, says that none of the pure bloods (so called) imported into Cape Colony from Turkey were free from kemp, and, further, "that kemp can and will be entirely eliminated from our [Cape Colony] best stud goats of our most intelligent breeders I have no doubt whatever," with which opinion I fully agree.—*G. A. Hoerle.*

In all crosses it will still remain, to some extent at least, on some parts of the body; for instance, on the belly.—*H. T. Fuchs.*

It will never disappear.—*Harris & Baylor.*

If only the pure-blooded Angoras are used as sires, kemp will be imperceptible in about six or eight generations.—*Col. William L. Black.*

There is but little in the very best.—*Abe Blackburn.*

There is not much after the fifth cross.—*Oscar Tom.*

In the fourth cross it nearly disappears, but never entirely.—*C. P. Bailey.*

I can not find kemp in my thoroughbreds, although I have found it in billies that I bought for pure. I think it can be bred out with proper care in selection of billies.—*George A. Houck.*

Other deleterious features.—The very short hair, mane, kemp, and the hair that has been cut twice in shearing are, together, called noils, and this must all be combed out before the mohair can be spun. The noilage in Turkish mohair is only 15 to 20 per cent. In our domestic product it runs as high as 40 per cent. Noils are worth only 14 to 16 cents a pound, the same as short wool for blankets.

In some sections of our country, where the climate is dry and the soil distinctly alkaline, the natural animal yolk disappears from the mohair, leaving it dry, frowsy, and harsh. The dust of the fine alkali soil penetrates the fleece, so that much of the mohair grown in those sections is loaded with it, amounting in some instances to 40 per cent in weight.

Markets and factories.—Two of the questions which the mohair producers were asked to answer were: "Do you have any difficulty in disposing of your mohair?" and "Where do you market your mohair?" The answers to the first question were all firmly in the negative except in one instance, where an Arizona producer replied: "I have no difficulty in disposing of my good mohair, but my short and kempy stock goes slow and at a low price (23 cents)." There is much encouragement in these replies to those who may fear that the markets may not demand the supply. The ingenuity of the manufacturers in working the better grades into woolen fabrics and the poorer grades into plushes which make good car seats, horse blankets, hats, etc., has, no doubt, opened the way for the consumption of all that may be produced.

As to factories, there are more than a sufficient number in this country to manufacture the product; in fact, many of them do not attempt to use mohair for the reason that the supply is so limited. These factories of the United States are all in the East, and the principal market for the mohair is New York. The marketing center of the world is Bradford, England, where practically all the product of Cape of Good Hope and Turkey is sold.

Very few of the mills will purchase direct from the producer. They find it preferable to buy from the commission merchant, as he separates and classifies the fleeces, and the purchaser is enabled to make personal inspection. A few producers ship their mohair to Boston, and others, especially some of those in the Northwest, sell to commission men in Portland, while others of the West sell in San Jose, Cal.

Production.—The production of mohair will be considered elsewhere (see p. 354) in connection with the world's production and the imports and exports.

MANUFACTURES OF MOHAIR.

One of the reasons why the mohair industry has lagged so in this country during the fifty years since the introduction of Angora goats is that the use of mohair goods was subject to the caprices of fashion. It would not be strictly correct to say that the industry has even got beyond the influence of fashion, but it is at least nearly so. There is now a steady demand for the product of our country, and much is imported besides. Dame Fashion is still whimsical toward all-mohair goods, especially dress goods, but the mohair is mixed with other fibers for producing fabrics of strength and luster, and the home supply is not nearly equal to the demand. Because of the limited and uncertain supply, some mills which have at times used mohair no longer attempt to secure it. They are prepared to use it as soon as the supply will warrant the undertaking.

Mr. George E. Goodall, president of the Sanford Mills, Sanford, Me., who has kindly furnished the Bureau with valuable information, states that his mills consumed 840,000 pounds of domestic mohair and 460,000 pounds of Turkish mohair in 1899, a total amount of 1,300,000 pounds. While these mills are believed to be the largest consumers of the domestic product, there are thousands of pounds consumed by other mills (see p. 354). This proves, first, that there is a good demand for mohair, and second, that the usual estimate of the domestic production in 1899 as being between 600,000 and 800,000 pounds is far below the real amount.

Only a small percentage of the domestic product of mohair is of superior quality, as has been shown in previous pages. The greater amount is of inferior quality from various causes: First, the fleece from the crosses, beginning with the first cross, is called mohair, and is indeed worth something; second, all of the crosses up to the fourth or fifth have a great deal of kemp in the fleece (it never disappears entirely from any cross); third, efforts have been directed too persistently toward producing a large fine-looking animal, the fleece being a secondary consideration; fourth, the staple, when of superior quality, is often too short.

Many grades of mohair are mixed with silk and wool in a large variety of fabrics in which it formerly was not used. It is made into dress goods known as mohair, and much of what is usually called alpaca is nothing less than mohair. The fine fabric called camel's-hair goods is also of the best mohair, and not from the camel, as we would suppose from its name. "Chamal" is the Arabic word for camel, and the Arabs called the Angora goat the chamal. Mohair braids contest the markets with silk braids and are never out of fashion. The ways in which it is used with silk and wool are numerous. It adds to these fibers not only its brilliant inherent luster, but great durability as well. The growers of mohair are fond of quoting Dr. Davis, who stated in the Agricultural Report for 1853 that "I have socks [of mohair] which I have worn for six years and are yet perfectly sound." He is also quoted as saying that while in Asia he saw wrappers of mohair used by the natives which, they assured him, had descended from sire to son for three generations.

Mr. William R. Payne, an authority, is quoted below on the uses of mohair:

> The most important product of the Angora is the long, silky, wavy fleece, used either pure or in connection with wool, silk, linen, or "carlton" in a variety of fabrics for house furnishings and ladies' goods, brilliantines, linings, braid, plushes, astrakhan cloth, furniture coverings, curtain material, knit goods, fancy effects in shawls and dress goods, and numerous other textiles. * * * The short, low, and crossbred hair is used for blankets, lap robes, rugs, carpets, and low goods generally, but even then is worth more per pound than most sheep wool, varying from 10 to 21 cents per pound. The uses for mohair are increasing every year, and new outlets are being found for it as manufacturers are advancing in the variety of their products.

THE MEAT AND THE MARKETS.

The meat.—In building up a flock of Angoras from common goats (a subject which is discussed elsewhere) the males must not be permitted to grow into bucks of breeding age; and even among the high grades there are comparatively few bucks that should be retained as such for breeding purposes. They should be castrated early. The great majority of these wethers, especially if they are of the first or second cross, do not produce sufficient mohair of good quality to warrant flock raisers in keeping them. These should be converted into meat as soon as large enough. Those wethers and does which produce a fair quality of mohair may be retained for that purpose for a few years and then killed for meat. They are not, however, so good for this purpose as the younger animals.

There is a deep-seated prejudice, as has already been stated, against the use of goats of any kind for meat. This is founded upon ignorance rather than experience. The most ill-smelling "billy" of the worst possible type is by many made the standard of goat meat for the whole of the goat family. As far back as Abraham's day we read of goats being used for meat (very likely Angoras), and this, too, when there were many cattle and sheep. Certainly no prejudice existed against them at that time.

There is not much to be said about the meat of the common goat. It is not so generally used as that of Angoras. The flesh of their kids is considered very fine, and in some sections of the country goats of all ages are killed for meat. There are comparatively few common goats in the United States, and no attempt is being made to put them upon the market. The current report that goats are sold to the packers in the large cities for canning purposes is true in the main, but refers to the Angora grades. The discussion of this question in this paper deals with the Angoras of all grades.

The flesh of the Angora is exceedingly nutritious and palatable. Shropshire lambs, which are considered as among the best kinds of meat, are said not to be superior to a well-fed and well-cooked kid. In the Southwest these animals are as readily sold for meat as sheep, and the market has never been overstocked. A gentleman in Texas found a ready market for his canned Angora mutton, but was compelled to close his cannery because the supply of goats was not nearly sufficient to supply the demand. In the Northwest the principal use of the Angora is for clearing bushy land, and consequently they are not so extensively used as food. However, in nearly every locality there some have been killed for mutton, and there has never been a derogatory statement concerning its quality, so far as the writer is able to learn.

In Cape Colony it is said that the old does are slaughtered to furnish meat for farm hands and young wethers are sold to butchers in the town. In California many miners purchase Angora wethers in preference to sheep wethers for salting down for winter use, because, as they state, the Angora contains less fat, is more easily kept, and is just as palatable.

Mr. John L. Hayes, in the Overland (1870), said that, in order to test the qualities of Angora and sheep mutton, a dinner was to be prepared with the two kinds of meat, and that the guests were not to be informed as to which was sheep and which was goat, but they were to decide upon the merits of the dishes.

> Twelve disinterested men were invited to partake of the dinner and express their opinions of the various dishes they had eaten. Four decided in favor of the sheep's and eight in favor of the goat's flesh; and since that breeders in Monterey County have no difficulty in selling their goats to the neighboring butchers for the same price paid for the best mutton.

Mr. E. H. Jobson, of Lake Valley, N. Mex., is authority for the statement that the wealthy people of St. Louis recently began eating young Angora mutton and that it is now a regular portion of their fare.

One of the questions to which the Bureau sought replies is as follows: "In your opinion, what are the relative values of Angora flesh and mutton?" Several answers to this question, with other quotations upon the same subject, are given herewith:

As a food there is no meat that is purer or more tender. It is better than mutton, as there is not that excessive fat to contend with that is found on sheep. This is a good feature in the Angora venison. In their feeding habits they are very similar to a deer, which alone is sufficient proof of the merits of their food qualities. A young kid is as dainty a morsel as can be found in the meat line. The wealthy people of St. Louis recently took up the fad of eating young Angora venison, and, as a result, it is now a regular portion of their fare; and that fad had done a great deal toward obviating the prejudice which has so long existed against the Angora venison as a food. Angora mutton is now being sold on the market at a fraction of a cent less than sheep mutton.—*E. H. Jobson, Lake Valley, N. Mex.*

If Angoras are castrated or spayed when early kids, and properly fed before marketing, and if this is not done too far away from the slaughterhouses, certainly not more than a two-days' ride (road travel), their meat is fully as juicy as Southdown mutton, while, on the other hand, it is never greasy. This is not only my experience in Texas, but was also that of Mrs. Sarah K. Barmore, of Rockland County, N. Y., who kept a flock of grade Angoras and sold the progeny to her neighbors, principally summer residents from New York City. She emphasized the point that her customers preferred it to ordinary mutton, because it was not greasy. Feed Angoras as much as you choose, they will never lay on fat in thick layers all through the meat, as in the case of other domestic animals. They gain, rather, like deer, in meat principally, which has a slight venison flavor.—*Gustav A. Hoerle, Ridgewood, N. J.*

It is a curious fact, but true, that black-haired animals have darker skins and darker meat than white-haired animals. This accounts for that whiter appearance of the Angora goat flesh, which enables the dealer to market it as mutton. The black hair, from a poetic standpoint, casts its perpetual shadow on the viand and leaves it shaded. The goat flesh is a pleasant and healthy meat. It should be so, since the goat is an eater of clean food, and is possibly the freest from disease of any quadruped.—*Queensland Agricultural Journal, May, 1900.*

The flesh of the Angora goat is said to be superior in flavor to that of any mutton. We have eaten several half-bloods and found them delicious. Some of the meat was put on sale in a local meat market, and the purchasers came back a few days later and wanted more good mutton like that they got the last time. This, we think, is a strong recommendation. The meat is juicy and sweet and has a game flavor.—*Miller & Sibley, Venango County, Pa.*

The Angora is much more nutritious than sheep mutton, especially where the meat is grown on underbrush (leaves), as the following compilation of relative values of feed will show:

Character of feed.	Protein.	Starch, etc.	Fats.
	Per cent.	*Per cent.*	*Per cent.*
Good pasture grass	3.5	9.7	0.8
Rich pasture	4.5	10.1	1.0
Leaves of trees	5.2	15.2	1.5
Red clover	3.3	7.0	0.7

It is often prescribed by physicians for invalids and children for this reason. The meat is excellent, and not distinguishable from mutton of the same age and condition. It is largely sold as such in many of the larger markets, being regarded as a staple in the districts where it is raised.—*W. G. Hughes & Co., Hastings, Tex.*

It is the universal testimony of those who are famillier with Angora goats that the flesh of this animal is far superior to that of the common goat. The Angora is quite as valuable for its flesh as for its fleece.—*Oregon Agriculturist, Portland, Oreg.*

The meat from Angora goats is fully as good as the most juicy mutton. This meat is sought now more than at any previous time.—*Kansas City Drovers' Telegram.*

Anybody who has ever tasted a roasted or barbecued piece of Angora mutton will find it is better than any meat they ever tasted. Angora mutton is worth in the markets about the same as sheep mutton. I sell it to my neighbors at 4½ cents per pound, and in town I sell it at 5 and 6 cents per pound.—*H. T. Fuchs, Tiger Mills, Tex.*

It is better than mutton, being free from the oily taste of sheep meat and partaking somewhat of the flavor of wild meat.—*George A. Houck, Eugene, Oreg.*

Angora mutton is far superior to that of sheep and brings just as much on the market. Being free from disease, why not?—*Josephus R. Barnette, Globe, Ariz.*

Superior, as they live principally upon leaves and weeds, which gives to the meat a game flavor.—*W. T. McIntire, Kansas City, Mo.*

It takes an expert to tell the difference; and, if there is a difference, it is in favor of the Angora.—*Harris & Baylor, Montell, Tex.*

I believe it is superior in that it is absolutely pure, with no superfluous fat, and is as tender as the finest of venison.—*E. H. Jobson, Lake Valley, N. Mex.*

I prefer the Angora or common goat flesh to that of sheep, though I have seen many people who could not tell the difference.—*H. I. Kimball, Maxwell City, N. Mex.*

I consider one as good as the other.—*Abe Blackburn, North Yamhill, Oreg.*

Young goats are fine meat, but old wethers are tough and strong, although good when boiled tender and served cold.—*Oscar Tom, Angora, Oreg.*

The young wethers make the best of mutton. The meat is rich and juicy and free from the strong taste so common to the meat of the common goat. I consider it equal to mutton. We have sold hundreds of head for mutton, always reserving the skins, which are worth green from 75 cents to $2 each.—*C. P. Bailey, San Jose, Cal.*

I think one is equally as good as the other.—*A. T. Waln, Salem, Oreg.*

Angora is very much the best.—*U. S. Grant, Dallas, Oreg.*

It takes an expert to tell the difference, or to tell Angora mutton from venison where the goat had access to brush.—*Cook & Buck, Oskaloosa, Kans.*

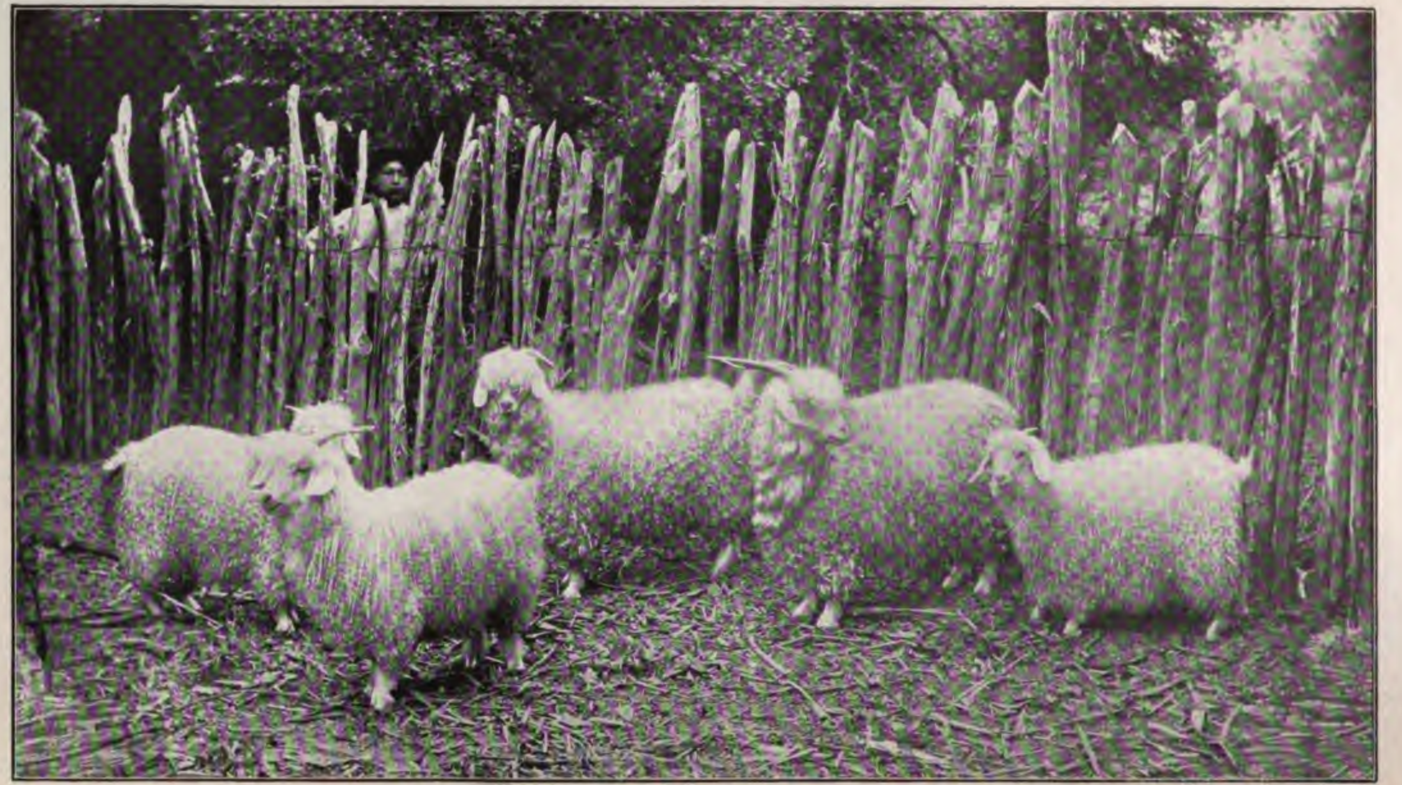
I value Angora mutton 50 per cent above sheep mutton.—*V. Cladek, Larwood, Oreg.*

Angora flesh is worth 12 per cent more than mutton.—*Richardson Bros., Dubuque, Iowa.*

It is preferable to mutton, as it does not have the woolly flavor so objectionable to many people. During the browsing season the meat has a venison flavor, but this is lost when corn is fed in the feed lot.—*R. C. Johnston, Lawrence, Kans.*

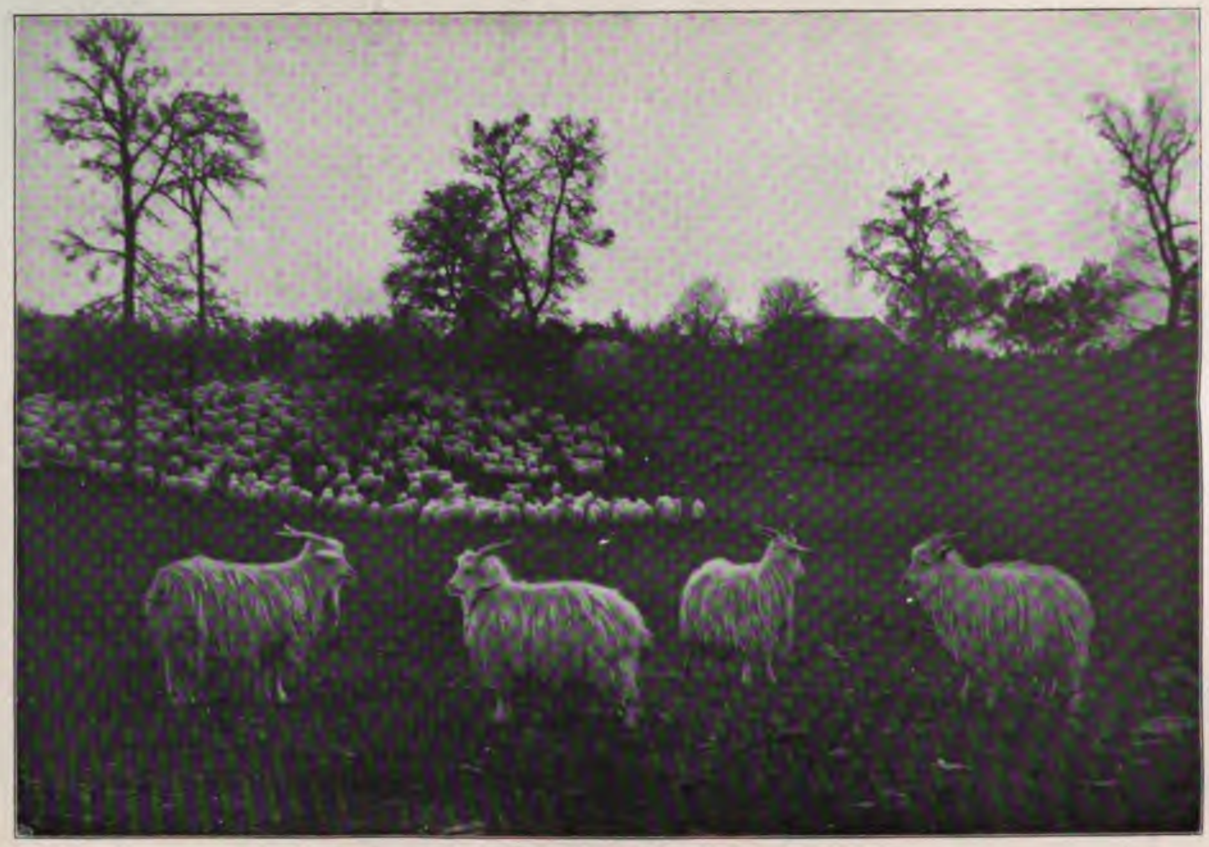
I am sorry we have no regular market for goat meat. It is as fine as venison when killed in condition and properly cooked.—*W. Brown, Salem, Oreg.*

Local butchers will pay 10 cents per pound for the carcass dressed, the seller retaining the pelt, which brings $2.—*I. McGovern, Libby, Mont.*



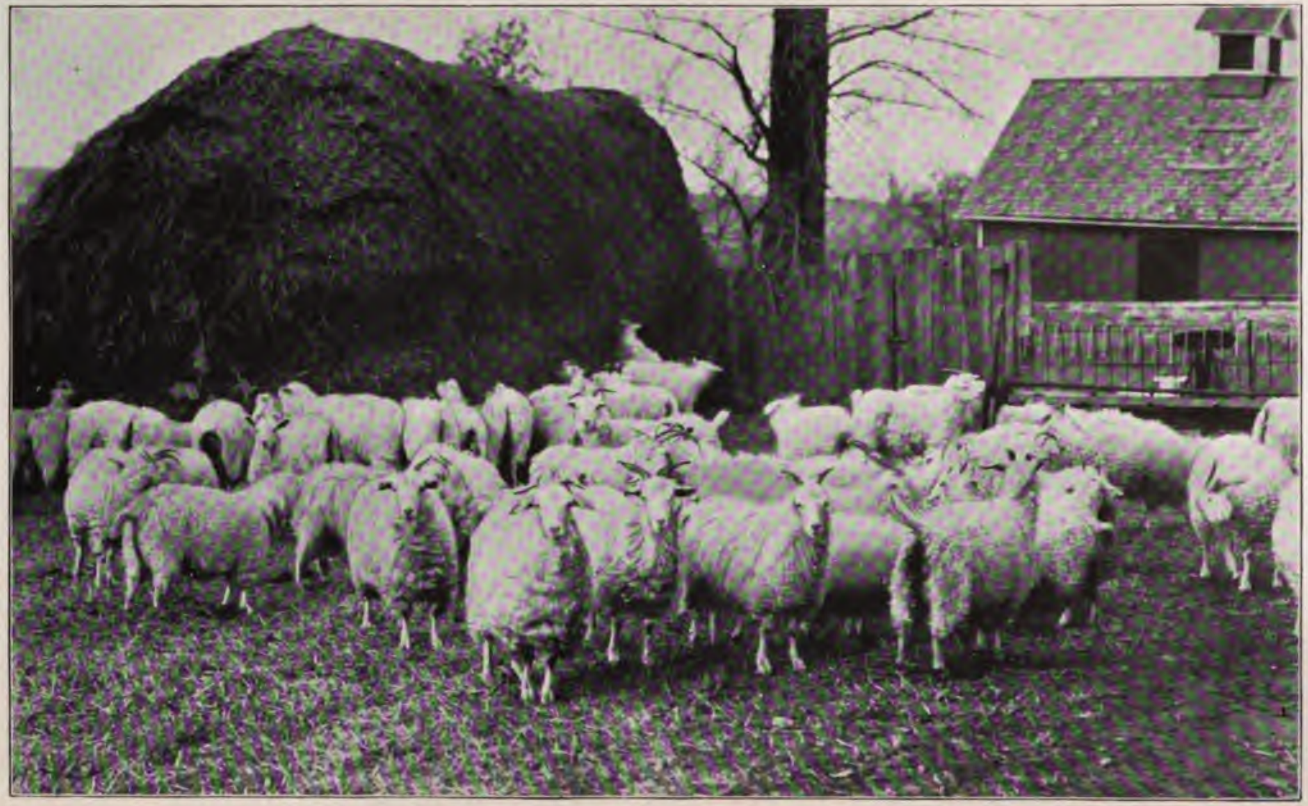
Angora Goats in Yard; also shows one Kind of suitable Fence.

(Photograph furnished by Harris & Baylor, Montell, Tex.)



ANGORA GOAT RANCH OF H. T. FUCHS, TIGER MILL, TEX.

(Photograph furnished by Mr. Fuchs.)



FLOCK OF ANGORA GOATS AT STRAW STACK.

(Photograph furnished by Capt. J. Murray Hoag, Maquoketa, Iowa.)

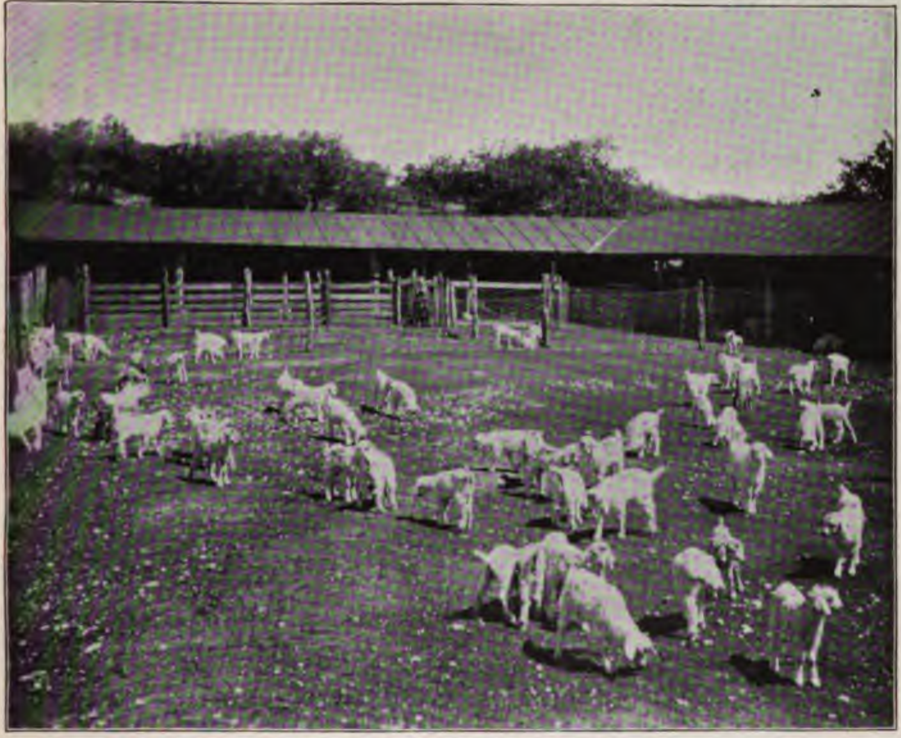


FIG. 1.—ANGORA KIDS.

(Illustration furnished by W. G. Hughes & Co., Hastings, Tex.)

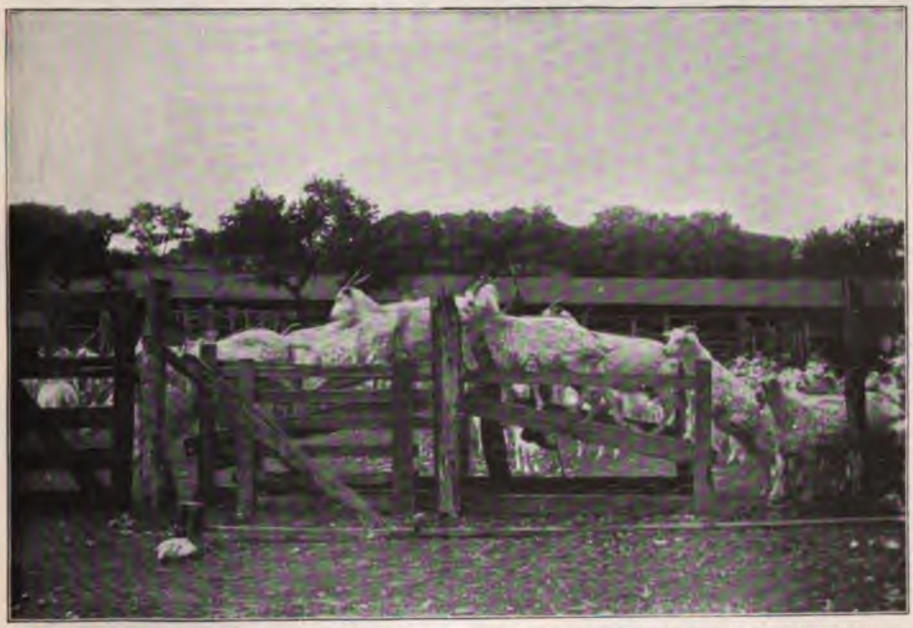


FIG. 2.—GOING TO PASTURE. (SEPARATION OF DOES FROM KIDS BY MEANS OF BRIDGE.)

(Illustration furnished by W. G. Hughes & Co., Hastings, Tex.)

The markets.—One of the first questions to be considered by a man who is about to embark in stock raising of any kind is the markets for his surplus. This question is first because it is the principal one and all important. The one who proposes to begin with a flock of thoroughbred or high-grade Angoras, such as will yield merchantable mohair, will not need to consider markets, as the increase will be employed to produce mohair; but a large number of flocks will be built up in the future, as they have been in the past, by the use of does of the common breed. This method will necessitate getting rid of every wether for two or three years. All does, of course, are kept for breeding with purebred bucks. It will be ascertained that the fleece of low grades is barely worth the cost of clipping it; that the skin is not so valuable for leather as that of the common goat; and that, as a rug or robe, the pelts are not so valuable as those of the higher grades. Therefore, if there is to be any profit from this part of a flock, there must be a market for the meat.

So many questions concerning this phase of the industry have come to the Bureau of Animal Industry that, in collecting data for this paper, it was decided to go beyond the newspaper accounts and ascertain the facts from the actual producers themselves. The question submitted was, "Do you have any difficulty in disposing of your surplus Angoras for meat?" The answers have been invariably in the negative. It should be said, however, that in the Northwest very few are used for meat. They are considered more valuable there as brush destroyers. The conditions obtaining there are not found in all localities where Angoras are raised. In many places Angoras will be kept where, instead of permitting them to destroy the brush utterly, efforts will be made to preserve brush pasture for them; in the Southwest they are not all required for destroying brush, and thousands must be sent to market.

The reason why goats are not seen oftener in the market reports of receipts and shipments is that they pass as sheep. It is stated, however, that increasing numbers are seen in the larger markets. In the Union Stock Yards of Chicago as many as 8,000 were received in one week last year.

While the goats pass as sheep, they are also sold to consumers as sheep. They have not yet brought as good prices as sheep, and it can not be hoped that they will do so until there is the same demand for their mutton, which will come as soon as the prejudice against goats disappears. The difference is very slight in some places. In Kansas City, for instance, the sheep bring about one-half a cent per pound more than goats. The packers buy them as goats and sell them as sheep in the form of dressed meat or canned.

Some of the answers to the question submitted by the Bureau are appended:

You ask if I have any difficulty in disposing of goats for meat. None at all. The packers here buy goats as goats and sell them as sheep. They make a difference of about half a cent a pound in favor of sheep when buying, and, as they never sell goats, they save that difference in selling.—*Thomas H. Mastin, Kansas City, Mo.*

None whatever.—*W. G. Hughes & Co., Hastings, Tex.*

Angoras bring now in Kansas City and Chicago within 4 or 5 per cent of the price of ranch sheep, while ten or twelve years ago not half that much could be obtained. Were it not for their unpopular name "goat," the meat would bring by far the highest prices in the retail markets—provided, of course, that they reach the market in proper condition.—*G. A. Hoerle, Ridgewood, N. J.*

I sell readily at the four large markets within 25 to 40 cents per hundredweight of the same grade of sheep. They are purchased by the packers. They dress out more meat than sheep.—*R. C. Johnston, Lawrence, Kans.*

We do not have to dispose of them for meat, as there are parties always anxious to buy. We would have no trouble to dispose of them for meat if we wanted to.—*Richardson Bros., Dubuque, Iowa.*

We do not. It usually sells for a little less than mutton.—*C. P. Bailey, San Jose, Cal.*

There is no sale here for goat meat. Wethers are generally used for their mohair or clearing land of brush.—*Oscar Tom, Angora, Oreg.*

There is not much use being made of them except for clearing land. A few are occasionally slaughtered here.—*Abe Blackburn, North Yamhill, Oreg.*

The demand for mutton goats is greater than the supply. We get good values for the mutton.—*E. H. Jobson, Lake Valley, N. Mex.*

They sell as readily as sheep, but bring from 25 to 50 cents per hundredweight less on the market.—*W. T. McIntire, Kansas City, Mo.*

None sold for meat here.—*V. Cladek, Larwood, Oreg.*

So far all goats are wanted for clearing brush land, and there is no trouble in selling them.—*W. Brown, Salem, Oreg.*

We have a local market which can use three times as much as we produce.—*Josephus R. Barnette, Globe, Ariz.*

Never had a surplus yet, being in demand at fair prices for clearing land.—*George A. Houck, Eugene, Oreg.*

None at all. If fat, the packers will buy them readily. If not, the sheep feeders will buy them for fattening.—*William L. Black, Fort McKavett, Tex.*

Have not. Have used and sold very few for meat, as they are in demand as brush killers.—*J. R. Standley, Platteville, Iowa.*

None at all. I could sell hundreds and thousands as easy as I could sell sheep.—*H. T. Fuchs, Tiger Mill, Tex.*

We do not, but on account of a prejudice against the name "goat," we have to sell at about 50 cents less than sheep bring.—*Conklin Bros., Newville, Cal.*

THE MILK.

The Angora is not primarily a milch goat, and is not often employed for that purpose. The information at hand indicates that the quantity of milk given by an Angora doe is uncertain, and only in exceptional cases does the amount approach that given by the established breeds of milch goats, such as the Toggenburg, Malta, and Nubian breeds. Some of the records of the earlier importations of Angoras into the United States show that some of them were milked with success. At this time, however, they are not recommended as milch goats; they are more useful in other lines. It is stated upon the authority of some of the oldest breeders in the country that the likelihood of finding a good milch goat among the Angoras diminishes as the grade of the goat is raised. The milking qualities evidently come from the side of the short-haired goats.

The quality of Angora milk is said to be equal to that of any other breed, and more nearly equal to human milk than that of any other animal. For this reason it is considered the best substitute for mothers' milk for infants. An analysis of goats' milk for the British Goat Society, with an analysis of cows' milk for comparison, is shown in the table below. It should be stated that the cows' milk was from a cow which was a winner at a dairy show.

Comparison of analyses of goats' milk and cows' milk.

Element.	Goats' milk.	Cows' milk.
	Per cent.	*Per cent.*
Water	83.21	87.56
Butter fat	7.30	3.63
Casein	4.18	....
Milk sugar	4.10	8.81
Ash	1.21	....
Total	100	100

The milk has an additional value in that the animal is practically immune to tuberculosis. Less than a dozen cases of tuberculosis in goats are recorded.

THE SKINS.

The use of Angora skins, other than for robes, rugs, and trimmings as described below, is not very extensive. The skin is of a more delicate constitution than that of the common goat, and so does not make such tough leather. While the skin may be taken as an item of salvage from an animal that has died or been killed for meat, it would not be profitable to raise them for leather alone. If such skins happen to have a good fleece upon them, they will be worth more for robes or rugs, but even then they would not be profitable alone. There must be other sources of profit in addition to the skins. Angora skins are manufactured into morocco for use in binding books, and excellent gloves are made from them which bring from $1 to $1.50 per pair.

An impression is widespread, based upon immature consideration, that Angora skins may soon supplant the great number of goatskins which we now import for leather, but the quality of the skin precludes any such possibility. Upon this point the Oregon Agriculturist says:

> It is a natural mistake to suppose that Angora goatskins are worth as much, pound for pound, as common goatskins. We have several times noted the fact that this is not the case. Angora skins, after the mohair has been sheared off, will bring only a little over one-half as much per pound as the skins of the common goat.
>
> The only way to keep at home the greater part of the money now sent abroad to pay for goatskins will be to raise enough common goats in the United States to supply the demand.

Hides should be kept clean and should be dried in the shade; sun-dried hides are worthless. If the skins are to be tanned soon after being removed, they may be salted. If they are not to be tanned soon, they should be dried.

ROBES, RUGS, AND TRIMMINGS.

Angora pelts are used quite extensively as carriage robes, and they make up into very handsome ones. There was a time when the buffalo, the wolf, and other wild animals supplied the demand for robes in this country, but the extinction, practically, of the buffalo and the great scarcity of the other animals has forced us to look elsewhere for substitutes. An effort is being made to substitute hides of the Galloway and Polled Angus breeds of cattle, but their high cost will prevent their extensive use.

These conditions have resulted in a greater demand for Angora skins for robes. The skin is sufficiently tough for the purpose, and the fleece is easily dyed any desirable color. This characteristic has enabled unscrupulous dealers to sometimes pass them off on purchasers as the skins of some rare animals. In their natural color, the whiteness and brilliancy of which can not be excelled, the skins of the kids and younger does are made up into robes for baby carriages. There are probably a greater number used for this purpose at the present time than in any other way.

As a general statement it may be said that Angora pelts are worth from $2 to $3. The real value depends upon many things—such as the size of the skin, the length of the fleece upon it, and the time of year that it is taken.

As rugs these skins are found in many households, and they are both ornamental and durable. They may be used in their original whiteness, or be dyed any color to suit. Their softness makes them very desirable.

They are extensively used for trimming for children's cloaks and coats. Some first-class skins have brought as high as $18 apiece for this purpose.

Mr. William R. Payne, of New York City, who has had much experience in handling goatskins, says:

Angora skins properly dressed are used, white or tinted, to manufacture rugs, robes, carriage mats, fur sets for children, trimming for ladies' furs, and also for dusters, horse head tassels, doll hair, and wigs. They are mostly imported raw from Cape of Good Hope and Turkey, and range in value, duty paid, from $1.50 up to $3.50 each, undressed. Domestic skins are worth from 50 cents for kids up to $2 each for large full-fleeced pelts. The low, crossbred, common skins and short pelts not suitable to dress are used by morocco and glove leather manufacturers, and are worth from 15 to 18 cents a pound for large sizes down to 10 and 11 cents for small ones and kids.

PROTECTION FOR SHEEP.

The ability and inclination of the buck to fight varmints has made him in many places a valuable acquisition in herds of sheep. It is said that dogs and wolves will not only not attack a grown goat, but will not venture into a herd of sheep where there is a buck goat. Many owners of sheep in this country recognize the value of the goat in this respect, and keep one or more for the purpose of protection for their sheep. This practice is especially desirable in pastures where there is no herder or immediate oversight. If one or two goats are placed when young in a herd of sheep they will remain with them all the time. An extensive breeder of Pennsylvania says: "While goats do not fear dogs, and will even fight, I prefer to keep dogs out. I have seen them drive a dog out of the yard, and oftentimes a single goat will protect a flock of sheep from attacks by dogs." If they are old and not accustomed to being with sheep, they will in all probability keep to themselves, away from the sheep. They may be depended upon to do this certainly if there is quite a number of them. They are more rapid walkers and more inclined to wander than sheep, and so will flock by themselves. Their protection to sheep will thus prove a failure.

It is quite amusing to see the courage of a doe when she protects her young kid from a dog, or hog, or flock of buzzards. Two of my neighbors' dogs got in the habit of killing my kids, and one doe protected her kid quite a while from the two large, vicious dogs until the neighbor caught one of the dogs and gave him a good whipping, when the goat assisted in this work by butting the dog with all her might. You should train the goats to be brave by taking your dogs into the goat pen with you, and, in case the dog refuses to run from a brave goat, scold the dog to make the goat think that she whipped him. If you had a tame wolf trained in that way you could train your goats to fight wolves.—*H. T. Fuchs.*

ENRICHMENT OF LAND.

The enrichment of land from the droppings of goats is decidedly noticeable wherever they are kept for a year or more. This factor is of no small importance where goats have been employed to clear the brush from land with the object in view of turning the land into grass pasture. Such land, especially if hilly and rocky, is usually in need of fertilizers of any kind if cropping is to be attempted upon it. The manure of goats and sheep is about equal in value. A California firm has been selling Angora manure for fertilizing fruit trees and lawns for several years. They get $6 a ton (delivered) for it in carload lots. Manure is considered as one of the resources in the best system of modern farming, and it should be taken into account by anyone who is keeping goats or contemplating doing so.

THEIR USE AS PETS.

The purebred Angoras are very graceful, and their beautifully shaped bodies and fine silky hair make them very attractive. There is no animal, except possibly the horse, that is more beautiful than these goats, and no animal is more cleanly in his habits. As pets for children they are very popular, if they can be kept where they will be harmless to vegetation and anything made of cloth. They have all the propensities of the common goat for destroying fruit trees and chewing any kind of cloth and of climbing upon roofs. All kinds of goats are mischievous in the extreme. The Angoras are tractable and are often harnessed to carts, as are common goats, and their beauty makes them more desirable for this purpose.

BY-PRODUCTS.

In the modern methods of economic production and manufacture nothing is permitted to go to waste. Whoever it was that said facetiously that the packers saved every portion of a hog but his squeal spoke the whole truth. The same truth applies as well to the carcass of any food animal. In the case of goats the horns find many uses, and the fat is said to be the best tallow known for the manufacture of candles. Any part of the carcass not useful in any other way is converted into fertilizer.

LOCALITIES ADAPTED TO ANGORA CULTURE.

CLIMATE.

So far as temperature is concerned, no place has been found that is too hot or too cold for Angoras. Although not partial to heat, they will stand it quite as easily as sheep. Shade is essential to success if the sunshine is very warm.

The climate in Angora, where the breed originated and is still supposed to flourish in its more perfect state, is extreme. A temperature as high as 85° F. is registered in the summer and as low as 0° F. in the winter. In Cape of Good Hope, where they are thriving well, the temperature goes higher in the summer, but not so low'in the winter. The United States presents a wider range of temperature, where, in southern Texas and New Mexico, it may go above 100° F. in the summer, and in Idaho as low as 30° F. below zero in winter. The range of localities where Angoras have done well is from Guadalupe Islands, in the Lesser Antilles, to Ukamak Island, belonging to the Alaska Peninsula. Mr. M. L. Washburn, superintendent for the Alaska Commercial Company at Kadiak, says: "On Ukamak Island we have a flock of Angora goats, which have increased 60 per cent a year since they were placed there. They have given very good results in mohair, which is of good quality and fine texture." There are a few small flocks in New England and in nearly every State west until the Pacific Ocean is reached. The Western States have many thousands. Mr. William M. Landrum is quoted as follows:

> White goats can stand any amount of cold and snow, but sleet and wind are very injurious. On the other hand, they can endure the scorching heat of the Tropics. Their fleece is best at an altitude of from 3,000 to 6,000 feet above the sea level. The fleece never sheds on the Guadalupe Island, 210 miles from San Diego, at an altitude of only from 2,000 to 4,000 feet. I have grown mohair there 2 feet long, of lovely texture. We had 80,000 wild goats röaming on the island without any attention, except in slaughtering season, when we sheared the Angoras and slaughtered from 14,000 to 15,000 common goats for their hides and tallow. The goats all ran wild and took care of themselves. We were not at one dollar expense on them.

In considering Angora culture it is of more importance to study the climate with reference to moisture rather than temperature. It should be remembered that the original home of the goat is high up in the mountains, where the air is not laden with moisture. Under like conditions it thrives best here. Lowlands that are wet or marshy are not at all suitable. The effect of such situations soon makes itself apparent in a flock of goats. Foot rot is apt to give endless trouble, and the feet will need much attention in other respects. Therefore lowlands with much moisture and high temperature are not recommended for goat culture. It is a historical fact that the first effort to transplant the Angora goat outside of Asia was a failure on account of these conditions. This was in 1554, when a few individuals were taken to Holland, but they soon died, owing to the moist climate.

The effect of climate has a great deal to do with the character of mohair. On this point Mr. John S. Harris, of Oakley, Idaho, who is a gentleman of much experience, is quoted:

> Mohair grown here in Idaho is very bright when scoured, and, owing to the electric currents which exist in the air, the hair possesses elasticity, a property requisite to mohair. Goats do not grow a long staple here, but owing to the cold it is very dense. Neither do they grow so heavy a fleece as in a milder climate, owing to the dryness of the air. Plenty of green, natural herbage the year round would produce a heavier fleece and ultimately deteriorate its quality.

A high altitude is a locality always preferable in goat culture. This is especially true with Angoras, as the climate in high altitudes seems to have a beneficial effect upon the mohair.

Colonel Black, whose experience covers a period of thirty years, says that the Angora goat will thrive in any part of our country, and the yield of mohair will be greatest in the colder States. He estimates that the yield can be increased fully 1 pound by removing the goats from Texas to any of the Northern States.

CHARACTER OF SOIL.

Almost any kind of soil, except wet and marshy land, is suitable for these goats. Their preference is mountainous or rocky land, where they find it necessary to climb mountain sides and rocky cliffs to browse. Such situations not only afford them satisfaction in climbing and feeding, but the rocks serve to keep the feet trimmed. This is an important matter, for on soils devoid of stones or sand the feet must oftentimes be trimmed by hand.

One of the reasons for the freedom of goats from most diseases is that they require pure water, and in no place is better water found than in the springs and rivulets of hilly or rocky localities. Goats also require much exercise, much more than sheep, and such situations satisfy this inclination.

However, it must not be understood that rocks and hills are essential, although they provide for the goat an ideal situation. As stated above, almost any kind of soil is suitable except wet and marshy land. Goats are not partial to water in any form—in the soil or in the form of rain, snow, or sleet—and they drink a very small amount. Keep the goats dry overhead and under foot.

LAND AVAILABLE FOR GOAT CULTURE.

The habits of goats, as set forth in the earlier paragraphs of this paper, suggest at once to the informed person that there are in the United States millions of acres of land suitable for goat culture which are now serving no economic purpose whatever. Much of this would answer for sheep raising, but much more of it is suitable for goats only.

In the northwestern States there are hundreds of thousands of acres of forest land which, on account of the forest covering, is useless, but when goats clear it of all underbrush and put it in proper condition for cultivation, as they are doing there at this time, the land becomes more valuable for other kinds of farm crops. In other places there is much brush land which it is desirable to have goats transform into good pasture land, and there are also vast acres of mountainous and hilly districts which are ideal locations for Angora goats, but which could be of no importance as pasture or as tillable land.

Capt. Almont Barnes, in the article entitled "Keeping goats for profit," makes some estimates of the amount of unimproved land in the country, basing his calculations upon the reports of the Eleventh Census. He finds that the total amount of unimproved land in the United States is 265,000,000 acres. In Maine there are 6,000,000 acres in farms, of which 3,000,000 are improved; in Georgia are 25,000,000 in farms, of which 9,500,000 are improved. He concludes:

> There is, however, in the United States a large, continuous area, embracing over one-third of the States and Territories, which invites particular attention in connection with this subject. It includes the South Atlantic and South Central divisions

ANGORA GOATS IN ROCKY PASTURE.

(Photograph furnished by H. T. Fuchs, Tiger Mill, Tex.)

ANGORA GOATS IN PASTURE.

(Photograph furnished by C. P. Bailey & Sons Company, San Jose, Cal.)

ANGORA GOATS IN PASTURE.

(Photograph furnished by H. T. Fuchs, Tiger Mill, Tex.)

and a part of the Western division of the Census groupings[1], or twenty States and Territories, which together contain nearly 285,000,000 acres in farms, of which over 122,000,000 are improved and over 162,000,000, or 57 per cent, unimproved. The average size of farms and the average amounts of unimproved land are greater in this area than elsewhere, and the climatic conditions are more uniform.

It is safe to say that it will be many years before the matter of available land for goat culture becomes a problem. It is sufficient at this time to know that there is an abundance of suitable land everywhere in the country.

Mr. W. Hammond Tooke, in the Agricultural Journal of Cape of Good Hope for May, 1899, says:

> He [Schreiner] admits that it is generally agreed that very large portions of the States are well adapted to Angora goats, an opinion formed from actual experience over a number of years. This being so, it is difficult to understand how it is that the industry has progressed so slowly, seeing that the hair is valuable, the skins in great demand, the flesh prized as good, and the tallow as good as any that reaches the Chicago market. It is not more easy to understand when it is considered that large portions of the country are suitable for goats and not suitable for sheep.
>
> There seems no reason, therefore, to the outsider why the industry should not make almost as rapid progress in the States as it has in South Africa.

THE CARE OF ANGORA GOATS.

The preceding pages have no doubt given the impression that Angora goats are very hardy, and, indeed, it is true, especially if their foundation is upon crosses with the common goat; but this should not be taken by the careless or shiftless man as a license to subject his goats to all manner of discomfort with the expectation that the results will be fully as satisfactory as if rational attention were given them. That these animals can withstand extreme cold, such as that of the islands of Alaska, or extreme heat, such as that of Guadalupe Island, is strong evidence of their fortitude and of their adaptability to a wide range of temperature under proper care. The same fortitude is exhibited by horses, cattle, sheep, and hogs, but no one thinks of turning these domesticated animals out upon their own resources, as wild animals are forced to exist. That they can subsist upon vegetation which is utterly useless for any other purpose is evidence simply of their economical keeping; it does not permit one to conclude that they never need any other kind of feed at times. In a word, it is intended here to impress the fact that, if satisfactory results are to be obtained in goat raising, the animals must receive the same rational treatment that is received by other live stock when best results are sought. The goat is a hardy animal in the fullest sense of the word, but this characteristic only enables him to respond the more quickly and satisfactorily to careful treatment.

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[1] South Atlantic division: Delaware, Maryland, District of Columbia, Virginia, West Virginia, North Carolina, South Carolina, Georgia, Florida; South Central division: Kentucky, Tennessee, Alabama, Mississippi, Louisiana, Texas, Oklahoma, Arkansas; Western division: Montana, Wyoming, Colorado, New Mexico, Arizona, Utah, Nevada, Idaho, Washington, Oregon, California.

HERDING AND FENCING.

Goats require a great amount of exercise, much more than sheep. The one is by nature a browser and the other a grazer, and the browsing habit naturally requires more activity on the part of the goats. They are sensitive to restraint and do better if not herded, but of course this is often a necessity, and therefore should be done under as favorable circumstances as possible. So far as possible they should not be allowed to feel their restraint. If constant attendance is necessary, the herder should be of quiet disposition. The next best thing to the freedom of a range is a large pasture, where the goats may have oversight, but not constant attendance. Such pastures are considered the cheapest method of keeping these goats. They can easily be trained to come home by feeding a little and salting regularly at home.

The fencing for pastures is a matter which early concerns one who contemplates going into the business, for it is the current belief that goats will climb onto any shed of ordinary height or jump any fence that will stop other animals. While they will climb anything that is built in such a manner that it may be climbed easily, they will not jump any ordinary fence. They will, however, creep through if there is an opening large enough. The old-fashioned "worm" fence, especially if it leans outward, will not stop goats. The angles in such a fence are an incentive and a delight to them. Indeed, there are many hogs that will go over a fence of this kind.

In building a goat fence there are other matters to be taken into account than simply that the goats shall be kept in: the animals themselves (especially the young ones) must be protected from dogs and wolves from the outside. In the Southwest it is much more important to fence to keep varmints out than it is to fence to keep the goats in. So the double object must be kept in view in building a goat fence. Such a fence must be dogproof, hogproof, and wolfproof. A hog at liberty which has once had the taste of chicken, or lamb, or kid is a greater nuisance than any wolf or dog, and should be dispatched as being an enemy to other young live stock as well as kids.

One correspondent of the Bureau constructs a fence of ten-barbed hog wires, with posts set 20 feet apart, having three stays between the posts. The lowest wire is only 1 inch from the ground; the next four wires 3¼ inches apart, and one-half inch added to every space above. It is necessary that all the wires should be kept very tight. This correspondent adds the interesting note that many wolves are killed by screw worms in wounds received while attempting to crawl through such a fence. A good fence may be made of woven wire 3 feet high, drawn on the inside of the posts, and a closely barbed strand of wire 3 or 4 inches above fastened to the outside of the posts to prevent animals from jumping in. A straight rail fence, if the rails are laid close enough, as well as an ordinary board fence, will turn goats.

Mr. Jobson says that a five-board panel fence 4 feet high is sufficient for goats. He also says that zigzag, or worm, fences are an incentive for the goats to climb, and that they will walk along the top of such fences as easily as on the ground.

If they are permitted to climb onto the roofs of buildings it will not be long before they will have them completely ruined.

SHELTER AND PENS.

A shelter is necessary during wet spells, and more especially if the rain is cold or in case of a sleet storm. Dry cold alone has little or no injurious effect after the kids are three or four weeks old, and they will even frolic in the snow when the mercury is at zero, and sleep with apparent comfort in an open shed. With their dense covering there is no reason why this should not be true; but this same dense covering, when soaked with cold water or driven full of sleet, is a deadly menace. Goats will not get wet if they have an opportunity to avoid it. They appreciate a shelter and will always seek it at night, and during the day in the event of storms. They are said to be excellent barometers, being able to foretell stormy weather, and always contrive to place themselves under shelter before the advance of a storm, if possible. Mr. Diehl says they will run miles to avoid an undesirable rain.

Goats should not be left on the range or in pasture over night. The latter is practiced to a considerable extent, but experience has shown that they are safer in closer confinement during the nighttime.

The pens in which the goats are kept at night should, above all things, be in such a location that they can be kept dry by drainage. Other live stock should be excluded, as they would only help to trample the ground into mud. They should have a dry place to stand and sleep, for they are apt to contract rheumatism in the knees. There would be little use in raising Angoras for their fleeces if they are compelled to wade through mud and filth, or be confined under these conditions. The fleece would soon become so soiled and matted as to be a "burden unto death."

The sheds provided for their shelter must be of a size to give an abundance of room. The goats should not, under any circumstances, be huddled together. If they are thus crowded in cold weather they will pile up, with the result that some of the younger ones will die from suffocation. One writer states that he has known as high as 30 being killed in this manner in one night. Mr. Oscar Tom, of Angora, Oreg., describes a shelter that proves satisfactory in the following language:

> The sheds should have eave troughs, and be boarded down to within 3 or 4 feet of the ground. There should be a ditch around the shed to prevent any water from running into it, and it should be open all around, so that the goats would not have to wait for others ahead of them to go in; a few cross ones could not block the way and

keep other goats in or out, and the rain would not blow in, but the goats would have plenty of fresh air. There should be a good fence around the shed at a distance of at least 50 yards, to keep cattle and horses from trampling up the ground and working it into mud. Have the fence high enough for the goats to go under, but never allow hogs to run into the goat shed, for goats are easily frightened after dark.

In some parts of the country the strong winds will blow rain under a shed such as Mr. Tom describes. In such cases, the side from which these storms usually come might be boarded to the ground. A better plan, in the opinion of some, is to have a few solid movable panels of fence to place around the openings of the shed on such occasions. This plan is convenient, too, as the panels may be taken away in fair weather, thus permitting a free circulation of air from all sides.

Shelter from the sun's rays should be provided for summer time. Although goats are able to withstand intense heat, they do not thrive well when subjected to it. For this purpose sheds more open than that described above are preferred, for the reason that the air will have freer circulation. Better yet than a shed against the sun's rays are large trees. In this case there is no obstruction whatever to the air.

FEEDING.

The principal reason why goats will be raised instead of sheep in some places is because they are practically inexpensive so far as feeding is concerned. This phase of the subject is quite fully discussed under the head of "Browsing and pasturage" (p. 298). They eat the leaves in summer and the soft twigs in winter, and if there is an abundance of either they will not require anything else to sustain life; but this condition exists only in certain localities, and other means must be adopted elsewhere. They are fond of straw and fodder of any kind. Plate XI shows where a herd in Iowa has access to a straw stack.

Notwithstanding the ability of goats to subsist upon coarse fodder in the winter season, the impression must not be held that they will thrive well upon it in the absence of browse. They will extract from these fodders all the nourishment obtainable, which is not very great, but must receive some supplementary feed. Any kind of grain will answer this purpose. Probably the best feed is oats, and if it is sheaf oats better still. In Texas some of the large goat raisers feed cotton seed by scattering it upon the snow so that goats will have to exercise somewhat in picking it up; besides, the time consumed in picking up the seed thus scattered insures better mastication.

In feeding grain care must be taken not to make the supply too liberal, unless the object is to fatten for slaughter. Goats easily become lazy on a plentiful supply of grain and will decline to go out to feed upon the brush. This is an important point, as their hardiness to a large extent is attributed to their feeding upon browse and to the resulting exercise.

As to the coarse feed for winter use, straw is eaten with relish; corn fodder is better and more nourishing; clover and alfalfa hay are excellent. Indeed, very little grain will be required where either clover or alfalfa hay is provided. Mr. Hoerle says:

> The quantity of food necessary to keep them in good condition varies according to the climate, but one-fourth pound of corn or its equivalent in other grain and 1¼ pounds of hay at a ration is about a fair average. With abundant winter pasture this ration once a day (in the evening) is sufficient; if the pasture is scant, they ought to have it both morning and evening, and on wet, cold days, when they are kept in the sheds all day, feed them three times or make their rations correspondingly larger. They should be taught early to eat their hay chopped, moistened, and sprinkled with bran, oil meal, or corn meal, which, if it digests easier if given in that way, will save about 20 per cent of the feed. They should also be taught to eat ensilage where practicable.

Sugar-beet pulp has been fed with success. The goats must be taught to eat it, but after once learning they seem not to be able to get enough.

In feeding either hay or grain absolute cleanliness must rule, as goats will not eat soiled food. There is no animal more particular about his food than the goat. He has no inclination for mud or filth in which to stand or walk, much less having to pick his food out of it. Bryan Hook, author of Milch Goats and Their Management,[1] says:

> The goat is of all animals the most fastidious in the matter of the cleanliness of its food, refusing, even though ever so hungry, to eat food that has been soiled or trodden under foot. For this reason a rack should be provided for the hay, and only as much given at each meal as the animal will consume, for that which has been trampled under foot will ever after be rejected, even though carefully collected and replaced in the rack.

When the production of mohair is reduced to a fine art, the question of feed will receive the most careful consideration, because of its influence upon the fiber.

The replies received by the Bureau to the question "Do you feed in winter? If so, what is the character of feed?" are interesting in many particulars. It will be observed that in the Southwest the treatment of goats in winter is not very different from that received by them in the summer. Below are given quotations from some of the letters received, credit being given to States only:

> Winters being mild, do not feed.—*Arizona.*
>
> I have to feed here. They like alfalfa best. In southern New Mexico they never need any feed, and are good mutton the year round.—*New Mexico.*
>
> We do not feed, there being plenty of evergreen brush.—*New Mexico.*
>
> Feed only during severe storms, perhaps an average of three days in the winter, and then any kind of good hay will suffice.—*Texas.*
>
> Feed some poor old goats on cotton seed and hay.—*Texas.*
>
> Winters are mild, and the goats live on evergreen brush (four kinds).—*Texas.*

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[1] Vinton & Co., Limited. London, 1896.

Feed only when the ground is covered with snow and sleet. I like shelled corn best. Feed in troughs or scattered on the snow.—*Texas.*

Yes; in stormy winters we feed hay so placed that they can run to it in the shed, for they must have shelter.—*Oregon.*

Native hay.—*Oregon.*

Very little; a few oats, and straw.—*Oregon.*

We manage to cut grubs in winter, but give them some straw; will eat most any kind of straw or hay.—*Oregon.*

I feed out in the prairie, along with the sheep; feed wild hay and lucern (alfalfa).—*Idaho.*

Hay, oat hay, and corn from shock, unhusked; some roots, and more or less bran.—*Iowa.*

Sheaf oats, fodder, straw, and hay in spring.—*Iowa.*

They run on the range all winter.—*Texas.*

Have never had occasion to feed, except during a snowstorm, when we cut down branches of live oak.—*Texas.*

Do not feed, except the bucks at breeding time; give them wheat hay and barley.—*Texas.*

In Nevada we feed our kids some alfalfa hay, at night, for two or three months.—*Nevada.*

I find shelled oats best for weakly ones; usually cut brush for the main herd during winter months.—*Oregon.*

We find clover hay and wheat and oats cut in the dough. We preter that to anything else.—*Oregon.*

Stock fodder and clover hay. They will do well on the same feed as sheep.—*Missouri.*

Not much grain, a little corn fodder, and wheat straw.—*Kansas.*

Shredded corn fodder, wheat straw, and a little corn in bad weather.—*Kansas.*

SALTING.

Goats require more salt than sheep, owing to the more astringent character of their food. If loose salt is used, the general custom is to give it once a week on regular days. If rock salt is used, it should be placed where the animals can get to it at any time. Rock salt is preferable, as it can be placed in boxes or troughs raised from the ground, and thus be kept out of the dirt and be of easy access to the goats at any time; and, too, there is no waste and no danger that the animal will eat too much of it.

MARKING.

The question of marking is always proper. Several devices are in use, but the metal tag in the ear is probably best known. A practice which appears to give satisfaction is to tattoo the numbers into the ear, using indelible ink. It is found that the metal is sometimes pulled out by brush.

KIDDING AND THE KIDS.

The kidding time is the most important in the life of the goats. For two or three days after the kids are dropped they are exceedingly delicate, and there will be no future success unless good care is given at the time. They can not "rough it" at this period, but will die from very little exposure or neglect. They are more delicate for a few weeks than lambs. When the kids are large enough to follow the flock they have constitutions stronger than lambs of like age and are able to care for themselves very well.

The proper time for kids to arrive is in the spring, about the time when leaves start on the trees and bushes. At that time there is milk-producing food for the doe, and the weather is also warm enough to favor the kids. The exact time may be governed, of course, by the service of the bucks and will be earlier in localities where the seasons are earlier. If kidding comes in cold weather, there will be greater difficulty in saving the kids. Warm stabling must also be provided, and the does will require extra feeding in order that they may supply milk for the kids.

A few days before a kid is due the doe should be separated from he flock. Some breeders would put her in a pen alone, while others would put as many as 20 in one pen. If the facilities are at hand, a mall pen for each doe is better, for the reasons that the doe will ooner "own" the kid and there will be less danger of injury than if mong a number. A doe knows her kid by the sense of smell, espeially when it is young. This characteristic is so strong that some breeders assert that if two kids of different mothers are rubbed ogether, the does will often refuse to own them. Whoever cares for he doe at kidding time will find it an important part of his work to ee that the does own their kids. This difficulty in any case will disappear in a few days, and it will then only be necessary to arrange for he does to get to the kids whenever they desire.

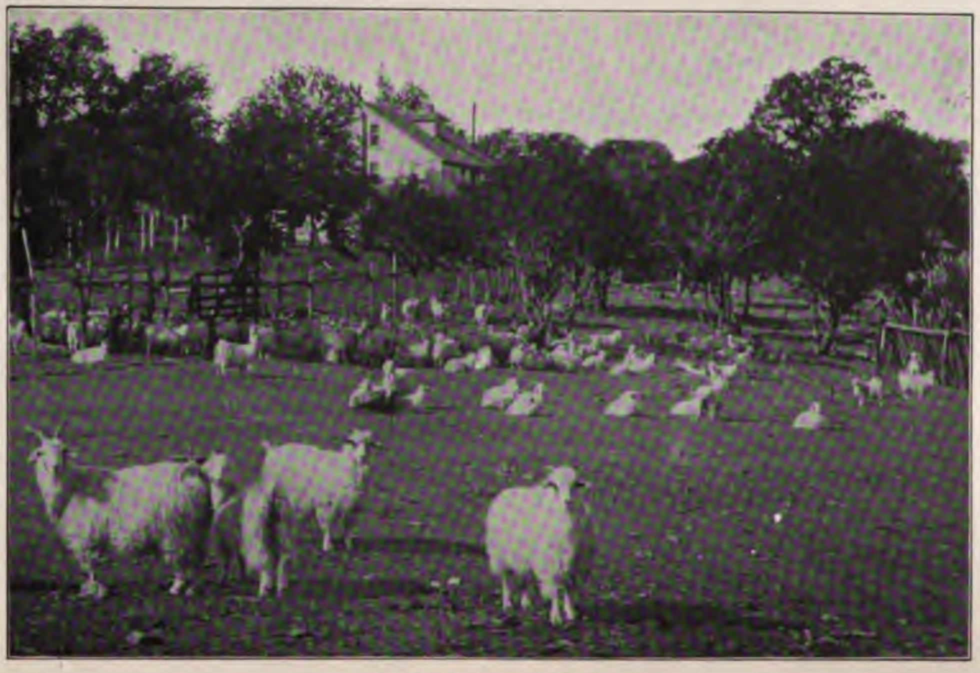
If kids are dropped on the range or in the pasture, they must be carried home and special care given to see that the does are made to own them, for many times they will refuse. A lamb will follow its mother very soon after it is dropped, but a doe will hide her kid as best she can in bushes, or behind a stone or log, and leave it there while she goes away to feed; and on her return she expects to find it where she left it.

The Mexican method of handling the kid is largely practiced in Texas and New Mexico and consists in "staking," or "toggling," the kid. When the kid is dropped, take it to a protected place (shed or barn), seeing to it that the doe follows, and "stake it out" or "toggle" t with a string about 14 inches long. Tie this string to one leg, hanging occasionally to other legs to avoid lameness. This string hould have a swivel in it to prevent twisting, and the kids should be carefully watched so long as they are so tied, which will be from seven to ten days.

The does should remain with the kids until they leave them of their own accord to go out for feed. The kids may then be allowed to run loose in a pen together until they are large enough to go out with the flock, which is when they are from four to six weeks' old, or when they are able to jump a board from 12 to 20 inches high placed across the gate. The height of this board restrains the kids that are too small to follow the flock and at the same time enables the does to go and come as they please. W. G. Hughes & Co., of Hastings, Tex., have a device for separating the does from the kids which is better than the board. It is a bridge, either end of which drops to the desired height. This device enables the does to go out and in without injuring the udder, which is apt to occur where they have to jump a board. A picture of this bridge in use is shown in fig. 2 of Plate XLIII.

The following is from "California Angoras," published by C. P. Bailey & Sons Company:

> There are in use two methods of handling kids at kidding time, namely, the corral method and the staking method. Each of these has points which render it most valuable under certain conditions and in certain localities.
>
> *The corral method.*
>
> This method may be used with any number of goats. With various modifications and adaptations which best suit the size of the flock, the climatic conditions, the facilities for feeding, etc., it may be used by the beginner with success. We have practiced this method in Nevada for more than twenty-five years. If the herd is a large one, say 1,000 head, three men are required to handle the goats at kidding time. The service of the bucks is so managed that the kids will be dropped gradually through several weeks. At the height of the season we expect from 75 to 100 kids a day. The season lasts about thirty or forty days. Fortunately, most of the kids are dropped in the daytime.
>
> We have four or five small corrals, fenced with 36-inch woven wire and large enough to hold 50 does and their kids. The doe should be allowed plenty of room, because if too close to her neighbor she may adopt the other doe's kid. Besides these small corrals, two large ones are needed, each large enough to hold 1,000 does. Along the fence of one of these corrals are a dozen small pens just large enough to hold a doe and kid. At the gate of this large corral a jump board is placed. This jump board is intended to keep back those kids which are not large and strong enough to jump over it. A 2-inch board about 18 inches high will answer the purpose. Another device sometimes used is a platform open at the end, so that the kids may run under it and thus avoid being trampled upon when the goats are going out over the platform.
>
> The small corrals may be made of panel fence and located in a meadow where some feed is afforded. The does should always have some kind of feed at kidding time.
>
> In the morning the flock is carefully examined, and all does which show signs of kidding during the day should be separated and placed in one of the small corrals. The large flock is now turned out, and one of the men is sent with them with instructions to take the herd at once as far as he intends to go for feed that day, and then



ANGORA GOATS IN YARD.

(Photograph furnished by H. T. Fuchs, Tiger Mill, Tex.)

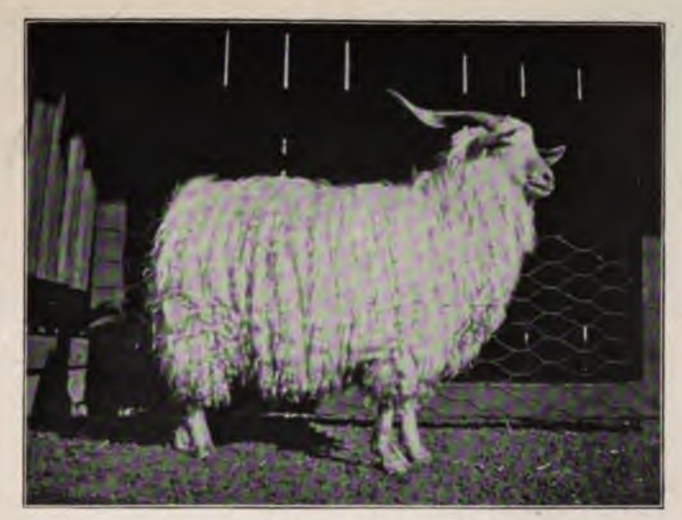


FIG. 1.—A YEARLING ANGORA GOAT.
(Photograph furnished by W. G. Hughes & Co.)

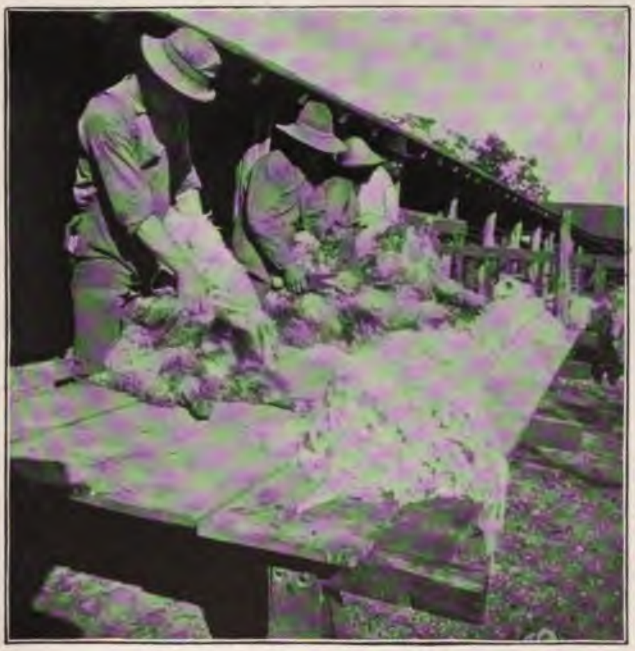


FIG. 2.—SHEARING ANGORA GOATS.
(Photograph furnished by W. G. Hughes & Co.)

to let them feed over a limited area and gradually work their way home. A few does will drop their kids on the range, and the herder should carefully note the number and their location. He should see that the herd does not feed around one of these does, as she is apt to leave her kid and join the band, thus necessitating much extra work in finding the kid and in giving it to its mother. Early in the afternoon the band is placed in one of the large corrals. Now the herder and another man go out with a wagon or on foot and carry the kids home, gently driving the mothers. The kids should not be handled or rubbed against one another more than is necessary, as the doe knows her kid by the scent. These does and kids are placed in the small corral which contains the does held back in the morning with the expectation that they would kid during the day. We now have one day's kidding in one of the small corrals. The does and kids should be watched to see that they are properly arranged. Do not bother them more than is absolutely necessary. Do not be in a hurry to make a doe own a kid. Do not drive the goats around one of the small pens.

The does should remain with their kids in the corral for a day or two at least, or until the kids are properly mothered. Any does which have not kidded should be taken out. The next morning any kids which may have been born during the night are put in another small corral with their mothers, as well as the does which are expected to kid during the day. The procedure of the previous day is repeated. In about three days, if one has limited quarters, the first day's mothers and kids may be put in the second large corral; that is, the one with the jump board at the gate. Now this "wet" band is placed in charge of one of the men and sent out to feed. The gate is opened, the mothers passing out over the jump board, and the kids remain in the corral. The herder must not range his goats near the does that are kidding upon the range, and he should be cautioned to come in later than the "dry" band, so as to avoid any possibility of their mixing. When his band arrives at the corral the gate is opened, and each mother hunts for her kid. Some of the kids may not find their mothers, and if after a day or two there are a few unnourished kids and some does with overdistended udders they should be placed together in the small pens along the side of the corral. The doe will own the kid in a day or two, whether she is its mother or not. The kids should not be allowed to become too weak before this is done. If one does not have enough small pens, a doe may be held while two or three kids suckle her, and thus tide them over until some of the small pens are vacant.

The next day the second day's kidding is added to the wet band. The wet band thus gradually grows, while the dry band decreases. During the day two men will be employed at herding the dry and wet bands, respectively, and the third man will be kept busy inspecting the kids, feeding the does in confinement, etc. If the weather is stormy some of the kids will have to be sheltered. The advisability of having the kids dropped gradually through a period of thirty or forty days will readily be seen. If help is inexperienced they may be gradually trained, or if the weather is stormy there will be time to get all things arranged properly.

The kids should not be allowed to go with their mothers until they are about 6 or 8 weeks old. If they go before this, they will probably become tired very soon and go to sleep. When they awake the band will have gone, and they are liable to be lost. During the day, while the mothers are feeding, the kids would eat a little grass if they could be herded near the corral.

As stated before, there may be many modifications of this method which will suggest themselves, but the above is a general outline of a method commonly in use.

The staking method.

This method is largely employed, even with large flocks, in New Mexico, but is possibly best suited to small flocks. It is without doubt the best method for certain surroundings. About the same amount of help will be required as with the corral

> method. There should be a good supply of stakes similar to tent stakes. There should also be a supply of swivel blocks which are about 4 inches long and having a hole bored near each end. A piece of rope about 6 inches long is fastened to the stake, and the other end is passed through one of the holes in the swivel block and a knot tied in the end. Another piece of rope of equal length is likewise knotted and passed through the other hole of the swivel block, the loose end being tied to the kid's leg. Any swivel will take the place of this primitive method. The herder or owner can busy himself during the winter months by making stakes and swivels and by cutting and attaching the ropes.
>
> When a kid is born it is taken to a convenient place to stake and the mother is gently coaxed to follow. The stake is securely driven into the ground, and the kid fastened to it by the hind leg. The mother is left with the kid, in order that she may know where to find it upon returning from feeding. The kid should be staked where he can get plenty of sunshine, shade, and shelter. A small bush, a post, or a box will answer the purpose admirably. If there are twins, they must be so staked that they can suckle at the same time. The rope should be changed from one hind leg to the other occasionally, to prevent unequal development. Sometimes a vigorous kid gets thoroughly tangled and requires help.
>
> The kid may thus be left staked until he is old enough to go with the flock, which is after six or eight weeks, or he may be put in a corral after a few days, as is done in the corral method.
>
> There are many successful breeders who use this method entirely. One may expect to get good results if he follows either the corral or staking method carefully.

There is very small loss among kids cared for as set forth above. Many of the breeders on a large scale report the percentage of increase as 100. This does not mean that every kid lives, but that so few die that the loss is offset by the number of twins that are dropped.

The most practicable fencing to be used at kidding time is made of portable panels. By the use of these panels a pen may be made large or small and be moved from one place to another without difficulty and with very little work.

Weaning.—Kids should not be weaned until they are 4½ months old unless they are very strong; but they should not remain with their mothers after they are 5 months old. This especially applies to the buck kids, as they will often breed at 6 months of age or even younger.

Castration.—The buck kids not reserved for breeding purposes should be castrated when about two weeks old. The earlier it is done, the better will be the meat and the mohair. It is pointed out in previous pages that the mohair from wethers ranks with that from the does, and the flesh is superior to that of the does and inferior only in small degree to that of the kids. A cool day should always be selected for the operation of castration and careful attention given for a few days.

Opinions of correspondents.—The quotations given below are a symposium of the opinions of most of the leading breeders of Angora goats in the United States on the matter of kidding:

> There are several methods of handling goats during kidding. The one employed here is the Mexican plan. When the kid is dropped take it by the hind legs, so that the doe will follow, to where you want to stake him. Stake with rope about 12

inches long, with wooden swivel in center. Leave them staked until after they are marked and castrated and well owned by the mother. Sometimes kids are herded with their mothers and sometimes by themselves until they learn to be herded. If not handled properly and the kids are allowed to mix together, the doe loses the scent of her kid, and young does will often disown them.—*F. O. Landrum, Laguna, Tex.*

This is the most critical period in the handling of goats. The kids are generally collected daily, as soon as dropped and able to stand and suckle the mother, and are confined in a corral for several weeks, much of the time tied to a stake driven into the ground. It is not safe to let them run with the flock until they are a month to six weeks of age, as they are liable to drop out of the flock and be lost.—*Col. W. L. Black, Fort McKavett, Tex.*

The kidding season is the time when the work and care comes. The kids are more delicate than lambs, and require a great deal of care.—*Harris & Baylor, Montell, Tex.*

The easiest way to get through kidding time is to put all the does that are soon to bring kids in a separate small pasture where they can be looked up easily. In case of bad weather they should be brought into their shed every evening before sundown; but if the weather is dry and not too cold they can be left out, and all the does will likely own their kids. Of course, the kids will not follow their mother as lambs do, but will lie down in a thicket or under a bush, a weed, a log, or a rock, and remain there till the mother comes back to it, even if it should have to wait till it starved to death; but after a kid is a few days old it is able to follow its mother, although it is best to keep the kids at home. Kids need not suck oftener than twice a day.—*H. T. Fuchs, Tiger Mill, Tex.*

I stake the kid in a barn for two weeks. The mother goes out in the daytime to feed and is put with the kid at night. After two weeks the kid is turned loose and kept in a pen until 2 months old, when it is allowed to go out with the flock.—*Henry Fink, Leon Springs, Tex.*

We keep the nannie and kid to themselves so far as possible for a day or so, and do not allow more than 20 nannies and kids in the same pen until the kids are over a week old, nor more than 50 nannies and kids in the same pen until 2 weeks old. Kids are kept in the pen day and night until a month old, and are then allowed to run outside the pen during the day to eat a little; the feed may be furnished them in the form of cut branches if there are no bushes near the pen. They should also have access to water after 4 weeks old. When 6 weeks old they can go out with the flock for a few hours in the afternoon, the flock being brought in at midday for this purpose. After eight weeks they can go regularly all day with the flock. We use a bridge for the purpose of "cutting back" such kids as should not go out with the flock.—*W. G. Hughes & Co., Hastings, Tex.*

Protection from rain; confinement in a corral or small pasture until the kids are 6 weeks old. We allow the does to jump over a 21-inch board to get food and return as they please. We separate all does every morning that will drop kids within two or three days and keep them in a pasture by themselves.—*Conklin Brothers, Newville, Cal.*

I put nannies that are soon to kid in an open pasture (not bushy). As the kids come, gather them into a corral with a shed or barn in it, taking the mothers with them. Keep the kids in the corral until they can jump over a 16-inch board, turning their mothers in and out evening and morning. At about 2 weeks of age they are usually fit to run with their mothers.—*George A. Houck, Eugene, Oreg.*

I aim to have a field of fall grain or reserved pasture to turn does in a few days before kidding commences, and turn the does in another pasture as fast as they drop their kids. Keep the kids up about two weeks, then let them go with their mothers.—*Oscar Tom, Angora, Oreg.*

Put the goats in a small pasture near a shed. If stormy, take the kid and doe to the shed at once. Every night put all the kids and does in the shed. Put bars up 20 inches high, and when the kid can jump over, let it go. Without a shed in this State you could not raise two out of ten kids; there is too much cold rain in kidding time—March and April.—*U. S. Grant, Dallas, Oreg.*

Put the nannies by themselves and then look after them once or twice a day to see that the kids are able to get up and suckle. Don't bother them, if they are all right and are in a sheltered place, until three or four days, and then change them to suit your convenience.—*W. W. Smith, Eola, Oreg.*

Take all the nannies out from the other goats as soon as they kid, and put them by themselves. I have about 100 small pens in which I put the nannies. Put the young nannies and old ones in different pens. Here they remain for four or five days and they are then turned into a larger pen, but not more than 50 should be put together.—*G. M. Scott, Malta, Idaho.*

Comfortable shelter and close watch to see that the kids get milk promptly. Put the doe and kid away from flock for a few days.—*J. Murray Hoag, Maquoketa, Iowa.*

We have a man on the spot all the time to help the goats in kidding, if necessary, and also to see that the kids begin to suck.—*Richardson Brothers, Dubuque, Iowa.*

Have good warm shelter, and under no circumstances allow cold rain to fall on the kids till after they are 2 weeks old. The shed should be open to the south, so that the sun can shine in on the kids. Turn the does out of the shed once a day, and leave the kids in the shed for the first two weeks. By that time the kids will be old enough to follow the doe.—*W. T. McIntire, Kansas City, Mo.*

I always keep the kids in a corral until they are old enough to follow the doe, which is when they are about thirty days old. In taking the kids to the corral care should be taken to get nothing on them that will change the scent, for does are very sensitive. If two kids from different does are rubbed together, the does will often refuse to own either of them. All kids should be castrated before two weeks old, as there is less danger and they do not get so sore.—*H. I. Kimball, Maxwell City, N. Mex.*

I cut out the heavy ewes from the rest of the herd, and hold them in a close herd, and catch the kids and bring them with their mothers to the corral, where each kid is staked separately with a toggle, or swivel, being careful to see that the mother knows where the kid is. After this I let the new mother goats come and go at will, only noticing them enough to see that they come to their kids regularly. The kids should be watched closely in order that they may not get tangled up and hurt. When they are about 2 weeks old they are turned loose in a corral and a board is put at the gate over which the mothers jump in going to and from their kids. When the kids are 3 months old they may be allowed to go with the herd.—*Josephus R. Barnette, Globe, Ariz.*

THE BUILDING UP AND MANAGEMENT OF A FLOCK OF ANGORA GOATS.

THE BEST FLOCK.

It is assumed that whoever goes into the business of raising Angora goats does so for the production of mohair, rather than meat or skins, and so it is to his interest to have a flock that will yield a profit from the beginning. The best flock for this purpose is one composed of thoroughbreds.[1] Such a flock will yield good mohair from the first.

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[1] The term *purebreds* is not used here, as there is strong objection to it by many of the best breeders, on the ground that there are no purebreds, as explained elsewhere. As the term *thoroughbreds* will exactly suit the purposes of this chapter it is preferred, leaving the question of *purebreds* to be discussed by others.

Those who enter upon the business of goat raising, however, must make their operations conform to their capital, the same as in any other business. They will find that desirable does will cost from $5 to $12 each, and bucks all the way from $50 to $100 each; so that a large herd of this kind, although preferable, will cost a small fortune, and is beyond consideration by most people who will engage in the industry.

BUILDING UP A FLOCK FROM SMALL BEGINNING.

Another plan that may be pursued by one who has limited capital, but time and the patience to wait, is to begin with a few first-class animals and build up a flock from these. The result will be satisfactory, and the only drawback is the length of time required. After all, this may be the wisest plan for most beginners to pursue, as experience, so necessary always to success, will be gained as the flock increases.

BUILDING UP A FLOCK BY CROSSING UPON THE COMMON GOAT.

It is noted in the historical part of this paper that the Turks many years ago began the practice of crossing Angora bucks upon Kurd does. They probably had in mind the twofold purpose of producing thereby a hardier goat than the pure Angoras and of increasing the number of goats in order to supply the increased demand of Europe for mohair. Crossing the Angora bucks upon the common goats of the United States has been practiced since their introduction, and the results have been very satisfactory in many respects. Many of the large flocks of Texas and New Mexico have had Mexican does for their foundation. Building up a good mohair-producing flock upon this plan requires five or six years. The advantages are that the does with which the beginning is made are cheap, costing from $1.50 to $2.50 per head. During the first and second crosses there are many twin kids, thus increasing the herd in that proportion—a condition not existing, except to a small extent, among either the purebred or thoroughbred Angoras; the size and hardihood of the progeny are increased and the liability to disease decreased.

Care should be exercised in starting a flock by this method to select only such common does as are entirely white; any other color, however slight, is objectionable. If otherwise, the results might be satisfactory, but the probabilities would be the contrary. In handling the crosses the breeder often finds that atavism becomes apparent when it is most objectionable. For instance, the progeny for two generations of a doe having black spots might appear all that is desirable, while the third generation would produce the latent color.

In starting with a bunch of common goats that you want to use for raising a graded flock of shearing goats you should use only as pure white goats as you can get, and you should allow no colored goats in the flock. You should also dispose of all those that have long, coarse hair on the thigh and on the fore legs, below the shoulder.

In fact, the common goats that you want to start your flock with should be nice and smooth built, with small head and short, smooth hair and small horns. From muleys you can raise heavy shearers, but their mohair is not quite so fine.—*H. T. Fuchs, Tiger Mill, Tex.*

If bred for the purpose of quick propagation, and with very fine, robust goats of both sexes to begin with, in six years five or six crosses can easily be obtained if nutrimental advantages are favorable; and if really first-class bucks, having all the most valuable points this side of perfection, can be procured, and inbreeding carefully avoided, even our common short-haired and smooth-coated goat will, after the fourth cross—say, beginning with the thirty-second—show improvement, which in a large flock on general inspection would defy detection by anyone but an expert judge of Angora goats.—*G. A. Hoerle, Ridgewood, N. J.*

It is always quite necessary that the common does should be of the short-haired variety. Long-haired ones will give trouble in persisting to throw out long hairs among the mohair.

The buck used upon these does should be the best one can afford. The better the buck, the better the result. There will be many twins among the kids from this first cross, and if proper care is exercised at kidding time it will not be difficult to increase the flock as much as 100 per cent. The higher the cross, the fewer twins will be dropped. As the fleece upon the first cross is not worth more than the effort to clip it, the males among them should be castrated when about 2 weeks old and disposed of for meat as soon as old enough. The females among them, being half-blood Angoras, are kept for service with another thoroughbred buck. The result of this second cross is three-quarter blood Angoras. The mohair from them has a marketable value, but is very limited in quantity and usually mostly kemp. It is best to deal with this cross in the same manner as with the first cross. If this method of procedure is followed up to the fifth or sixth cross a flock will result that will produce most excellent mohair.

It has no doubt occurred to the reader that we now have four or five different grades of does, beginning with the common breed. Therefore after a thoroughbred flock has once been produced in this manner, each year brings forth another one from the same sources, and this condition continues as long as the breeding life of the does continues.

PROPER AGE FOR BREEDING.

Goats of both sexes will sometimes breed when they are 5 months old, and often at 6 months, but from the fact that they are at this age but a month or two from weaning time and are not nearly full grown, it is obvious that they should not be permitted to breed. They reach maturity when about 16 or 18 months old, and they ought not to breed before this time. If bred earlier the kids will not be so strong or so well developed. They are in their prime when from 2 to 6 years old, but with proper feeding in winter they have been known to breed regularly until 15 years old. The average life of goats, however, is about 12 years. There should be no tendency to keep does until they are very old unless they bring kids of exceptional merit, for it must be remembered that their mohair gets coarser, and consequently less valuable, as they grow older.

The accompanying illustration (Fig. 1) shows how the age of goats may be determined until they are four years old. After that, in the absence of definite information, the age is a mere matter of guess, based upon the general appearance of the animal. The new teeth are longer and larger.

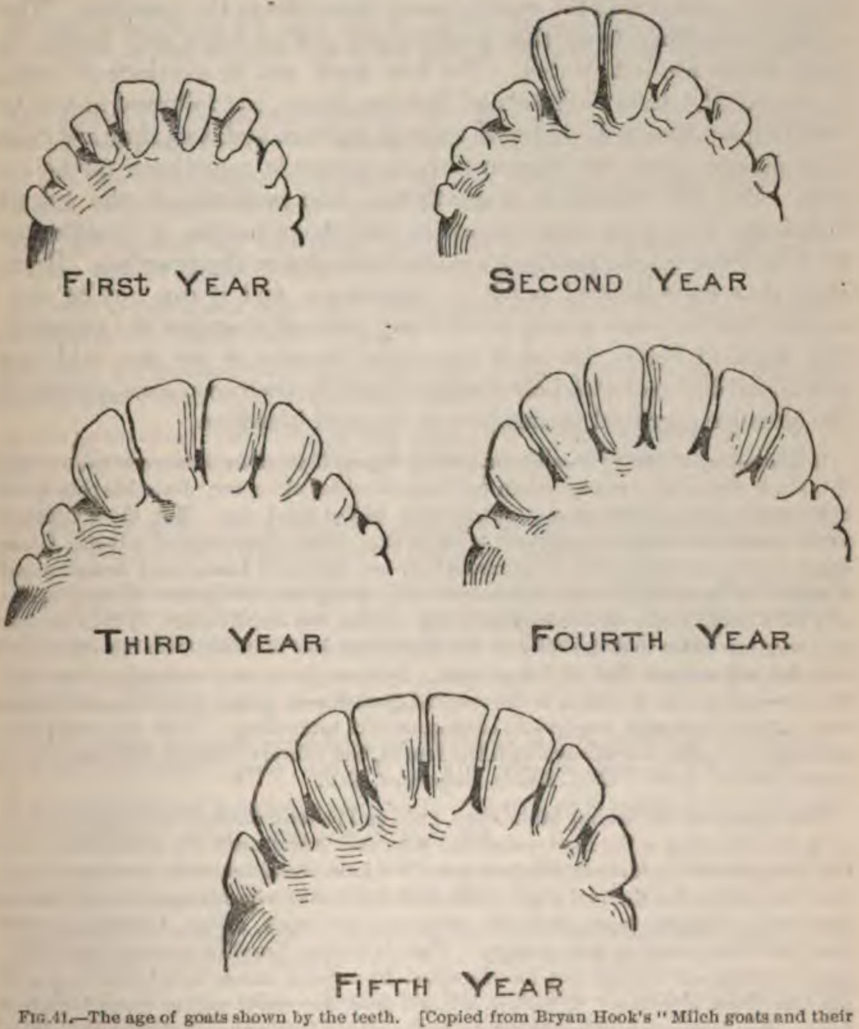

FIG. 41.—The age of goats shown by the teeth. [Copied from Bryan Hook's "Milch goats and their management."]

IN-AND-IN BREEDING.

In-and-in breeding means the breeding of related individuals. The term is indefinite, and with some refers to a close relationship and with others any degree of relationship. The correspondence of the Bureau with goat raisers shows that the term with them means generally the breeding of individuals of close relationship.

It is safe to say that there is an overwhelming sentiment against the practice. This will be apparent after one has read the replies which are published herewith to the question, "What is your opinion of in-and-in breeding?" It is quite generally agreed, however, that this practice will give a fleece of finest fiber, having a beautiful luster and little oil, but the weight will not be so great. Those who favor the practice contend that the quality more than offsets the quantity. The animals resulting from this practice are not so large and strong as those which are not related. The fact must not be overlooked, however, that Mr. John S. Harris, of Oakley, Idaho, has followed in-and-in breeding continuously and with evident success, and, too, they are kept in a climate where the temperature in winter is sometimes far below zero. But Mr. Harris is a gentleman who understands the art of breeding; if all goat raisers knew so well the principles of breeding as he does there might not be so many to condemn the practice. However, they have learned much by experience, and it can not be contended that they are wrong in advising generally against the practice. Col. Richard Peters, the most successful breeder of his day, said that half-blood does can with best results be bred to their own sires, provided the sires have proved themselves to be good breeders.

If inbreeding of closely related animals is meant, it should not be resorted to with live stock of any kind except when individuals which show very desirable points are at the same time of very strong constitution and of good size. But, then, I would never hesitate to breed even parents to children. Strict observance of this rule I consider doubly necessary with Angoras, which are naturally tender and delicate, and it should be risked only when chances are very strong that the gain of fleece or shape will fully compensate for the inevitable loss of size and constitution. I believe that in a very few years that the value of the annual product of meat (from her offspring) of a doe will surpass that of her mohair. Besides, the more constitution is gained, the more apt are we to return to the original prolificness of the goat tribe, which has been entirely lost with Angoras in consequence of inbreeding. With the third free generation usually, but always with the fourth, bad effects of mating relations would not be felt any more.—*G. A. Hoerle, Ridgewood, N. J.*

The opinion of our leading authorities, such as Professor Sanford and others, is that in-and-in breeding is the most successful way, and many cases are cited where this has been carried on for over thirty years. We have some breeders here who have been inbreeding for the past eight years, and the result, when the greatest of care is exercised, is that we have produced some very fine stock, as fine, I believe, as any that has been raised in this country. This in-and-in breeding is a very particular piece of work and should not be attempted by anyone unless he intends to give it his undivided attention. I believe it is the most successful way to breed for a fine fiber. The greatest trouble seems to be in the size of the animal, but if careful attention is paid to the work there is no excuse for losing size. We have demonstrated beyond all doubt that in-and-in breeding produces a finer wool, a longer wool, and a better wool; so if one desires to breed for fine wool he will have to follow in-and-in breeding.—*E. H. Jobson, Lake Valley, N. Mex.*

I think that to get a perfect goat one should inbreed to the finest buck or ewe obtainable; but don't keep it up too long, as the goat will be small and weakly.—*Josephus R. Barnette, Globe, Ariz.*

We think it should be avoided so far as possible, as it reduces the size and general stamina of the goat.—*W. G. Hughes & Co., Hastings, Tex.*

It will ruin a flock of goats the same as any other animal.—*R. C. Johnston, Lawrence, Kans.*

If done properly, closely watching defects, it is all right.—*J. R. Standley, Platteville, Iowa.*

Would not practice it if I could help it. We want goats with long, fine mohair, but at the same time we must look to the build of the goat.—*Q. M. Beck, Beargrove, Iowa.*

Am opposed to it on general principles. Would prefer it, however, to a moderate extent, to using inferior sires.—*J. Murray Hoag, Maquoketa, Iowa.*

I don't like inbreeding, as it weakens the goat. They don't have the ambition that fresh blood imparts to them.—*G. M. Scott, Malta, Idaho.*

They will be small and not strong, and harder to raise; will not shear so much, and more difficult to keep in flesh.—*W. W. Smith, Eola, Oreg.*

My stock are all inbred (600 does), but they are very small and tender. Would not advise it.—*V. Cladek, Larwood, Oreg.*

Once will do, provided you have an extra buck. After that you weaken the constitution of your goat.—*U. S. Grant, Dallas, Oreg.*

It can be practiced to advantage in producing a fine fleece, but if indulged too much will weaken the constitution and the goat will be small.—*Abe Blackburn, North Yamhill, Oreg.*

I believe, by careful selection of bucks, they can be improved, but I prefer crossing with new blood when it is just as good.—*Oscar Tom, Angora, Oreg.*

It shatters the constitution without a relative gain in weight of fleece. Fine mohair and light fleeces are all right, but I don't practice inbreeding. It produces such a goat as the practical man does not want.—*George A. Houck, Eugene, Oreg.*

We do not approve of it on general principles, but have not experimented much along this line.—*C. P. Bailey, San Jose, Cal.*

Under certain circumstances inbreeding for points in thoroughbreds is necessary, but it will degenerate a grade herd very quickly.—*Conklin Brothers, Newville, Cal.*

I do not like it and have never practiced it. I have seen it practiced, and the goats lack constitution.—*Henry Fink, Leon Springs, Tex.*

It brings the mohair to the greatest fineness if properly managed, but it should not be kept up too long.—*H. T. Fuchs, Tiger Mill, Tex.*

It is beneficial in the matter of improving the fleece, but a decided injury to the constitution and size of the animal.—*Col. W. L. Black, Fort McKavett, Tex.*

I used one billy five years. He was the best goat that I ever saw, shearing 10½ pounds of clean mohair annually.—*G. B. Miller, Gervais, Oreg.*

Inbreeding makes the fleece thinner and shorter and the constitution of the goat weaker.—*F. O. Landrum, Laguna, Tex.*

MANAGEMENT OF THE BUCK.

Bucks usually come in heat about the middle of July and continue so about six months; does, however, do not usually come in heat until the latter part of August or the 1st of September. As the period of gestation in goats is from 147 to 155 days (or about five months), care must be taken in mating the animals in order to have the kids dropped in proper season, which will vary somewhat with the locality. The kids should not come before the warm days of spring, or when vegetation begins to put out vigorously. Therefore the buck should be put to service from November 1 to December 1, so that the kids will come about the 1st of April or May. The only objection to earlier kidding is the extra care required to preserve the life of the kids, for they are exceedingly delicate for a few days, as has been stated before, and even a little cold at this season will probably prove fatal.

A buck, like any other domestic animal, should be in the best possible condition when put to service. He should be well fed with grain for a few weeks before this time, and the feeding should be kept up until a few weeks after his service is ended.

As to the number of does which a buck may serve, there is a great diversity of opinion. The greater number of goat raisers, however, think forty or fifty is all that may be served with good results. Col. Richard Peters wrote that he had obtained the best results with two hundred breeding does by turning in with them ten selected bucks. His object was to have the kids come as nearly at one time as possible, thus shortening the period of careful watching. Referring to Colonel Peters's practice, Dr. J. R. Standley says he regards it a great success, and will adopt it in the future. He says, further: "I have tried the one-service system, also turning in bucks at night, removing them during the day, and other plans, but decidedly prefer Colonel Peters's plan."

Where there are very large flocks it is not always desirable that the kids should all come at one time. If they are dropped at intervals for a month one attendant may thus be enabled to look after a large number, whereas if all come about the same time one attendant could not do the work, and assistants who may be strangers to the flock would be necessary. (It is not well to have many strangers with these goats at any time, and certainly not at kidding time.) Upon this point Mr. G. A. Hoerle has written out a plan, given below, which is quite generally followed where there are large flocks:

> A great difference of opinion exists as to how many ewes an Angora buck should be allowed to serve. This depends both upon the bucks and the condition they are in, as well as upon the length of the period during which you want the kids to drop. In a small herd, and where ample conveniences for kidding are furnished, so that good care can be taken of all the kids at once if necessary, one buck should serve from thirty to fifty (as above said, according to the animal); but should the flock be large, and owing to the uncertainty of the climate or the insufficient help or shelter

it should be desirable to have the kids drop gradually, say during a period of two months, especially when winter kidding is made a practice, from 75 to 150 ewes for each buck is not too much—again, according to animal and time. They should not run with the entire flock at once, but begin with say one-third to one-fourth of it, according to circumstances. The next similar fraction should be put in the breeding flock from two to five days later, and so on until gradually the entire flock is with the bucks. In this way a full crop of kids would be insured and at the same time the bucks prevented from doing excessive service.

The handling of "riginals" (ridgels) should have a word here. If the one testicle which descends is removed, the riginal will not get kids, but he will bother the does. If the descended testicle is not removed, he will breed without difficulty. He should be killed as soon as practicable.

NUMBER OF KIDS.

Thoroughbred Angora goats do not often drop more than one kid at a time, while the common goats nearly always drop two. There are many twins with the first cross, but the number diminishes as the crosses become higher. It is stated that the purebred Angoras never dropped but one at a time, and that the presence of twins in a flock is evidence of a base origin of the goats. The latter statement is disputed by some, who believe that the purebred Angora (having no trace whatever of base blood) will drop twins as regularly as the common goat.

SIZE OF FLOCKS.

All goat raisers agree that Angoras can not stand crowding together; and the higher the grade of the goats the more susceptible are they to injury from crowding. But to state just how many should be kept in a flock is difficult, as the number depends upon the character of their restraint. Where they have the range at day and large yards at night, the flocks may be very large, but where they have pastures and small pens at night the flock must not be large.

Writers upon the Angora industry have placed so much stress upon the point of overcrowding that the Bureau sought for information upon the question "What should be the size of Angora flocks?" Each correspondent replied with his own experience, and the conclusion is reached from the replies that they may be handled in flocks about as sheep are handled, the number depending wholly upon the capacity of the range or pasture, as the numbers reported for flocks are from 100 to 2,500. However, the danger from crowding is not disputed by any of the correspondents, and many of them mention it specifically. This phase of the matter must be carefully considered in connection with the question of housing and shelter. These must be ample to afford abundance of room and fresh air.

It is stated by some that goats running in small flocks shear more than the same number running in large flocks.

DEHORNING.

Dehorning the goats has received very little consideration, and it is probable that Mr. Q. M. Beck, of Beargrove, Iowa, is the only goat raiser who is now practicing it. Many other breeders report that they do not dehorn but believe it practicable, while a very few express opposition to the practice. Mr. Beck writes as follows: "I dehorned forty-five head last fall (1889) and found it a success, as it stops a great deal of bunting, which is liable to cause abortion, saves shed room, saves broken legs, and will save many kids." These same reasons have brought the dehorning of cattle in quite general favor among feeders, and it is probable that as the Angora goat industry grows into a larger industry the practice of relieving the goats of their uncivilized weapons of warfare will be generally adopted.

Mr. Beck dehorns in the fall after all flies are gone.

A different view of the question of dehorning is taken by C. P. Bailey & Sons Co., who dehorned 250 head which were in a band by themselves. They bunted as much or more than before the horns were removed. "Goats always butt each other, but we have never seen any ill effects resulting, except occasionally a leg being broken from being caught between the horns. It deprives them of their only means of defense, and we consider it unnecessary and objectionable."

SHEARING AND SHEDDING.

SHEARING ONCE OR TWICE A YEAR.

In Texas, New Mexico, Arizona, and sometimes in California shearing is done twice a year—in the months of March or April and in September or October. The reasons are that, owing to the warm climate, the fleece will often shed in the fall if not clipped. Mr. H. T. Fuchs, of Tiger Mill, Tex., says: "I find it quite necessary to shear twice a year, as they suffer too much from heat in the summer and autumn and even during the warm days in winter if they are not sheared about the middle of September, and in the springtime as soon as they begin to shed their long silky hair." There are instances in these localities where goats carry their fleece through the year, but all breeders, except in some parts of California, report the practice of shearing twice a year. In the other parts of the country shearing is done but once a year, and that in the months of March or April. The rule for shearing time does not depend so much upon the calendar as upon the condition of the fleece. It should not be delayed until the fiber begins to shed, as then the oil will begin to go back into the body of the animal, the mohair thus losing its life and luster.

As to the relative values of the semiannual and annual fleeces, there does not seem to be much difference of opinion. The semiannual fiber is shorter and therefore less desirable for fabricating, and the price is not so high as for that of the annual fleece. It is generally agreed that the two shearings combined weigh a little more than the annual shearing, but probably the increase does not average more than a quarter of a pound. However, some who have practiced it report that the gain is not equal to the cost of the second shearing, and that shearing twice is done from necessity rather than from the standpoint of profit.

USE OF CLIPPING MACHINES.

The use of clipping machines, although largely employed among large sheep raisers, has not yet come into general use among goat raisers. Those who have used them indorse them, and they will no doubt soon come into general use. They are more rapid than hand work, and the results are more satisfactory. The cutting of the skin is easily avoided in reasonably careful hands, while it requires extreme care with hand shears to prevent cutting. Mr. H. I. Kimball, of New Mexico, says of the use of the machines: "I sheared them [the goats] myself faster than the best hand shearer I ever saw, and I got a better price for my mohair." Another gentleman says: "I will say that the clipping machine for sheep will work well on goats in every respect. I have sheared ten goats in one hour and done up the fleeces."

Of course, the goat raiser will consider the relative cost of shearing with machines and by hand before he will purchase a machine. The decision will probably depend upon the number. The cost of hand shearing is about 4 cents a head. In the Southwest there are Mexicans who follow the profession of shearing sheep and goats; these usually receive 2 cents a head with their board. Many of them will shear 85 or 90 a day, the average of all being about 60. Any man who can shear sheep can shear goats. If shearing is done by hand, a short-bladed shear should be used in order to avoid cutting the hair twice.

Another objection to hand shearing is that there is often double cutting of the hair. The result is a shortening of the fiber and an increased amount of noilage.

If the animals are well cared for during the year, their fleece will not require washing before clipping. One writer of experience says that "the natural habits of the Angora goats are clean enough to enable spinning before washing, at least for some purposes." Any dirt that may adhere to the fleece should carefully be picked off after shearing.

CARE OF THE FLEECE AFTER SHEARING.

The operation of shearing should be done in a building free from straw and dirt, which might adhere to the fleece after it drops from the goat. It should then be rolled up, inside out, and packed in the sack without being tied in any way. This is the manner in which the mills desire to receive it. The practice of tying the fleece with almost any kind of twine that may be at hand obtains very largely among goat raisers, but the wishes of the mill operators are already receiving proper attention. The reasons why the mill operators do not desire fleeces tied are very forcibly stated by one of them (George B. Goodall), as follows:

> I want to mention another evil which should be corrected, and that is the use of twine or string around the fleeces. Vegetable fibers will not take dyes used for animal fibers, and in cutting these strings by the sorters more or less of the vegetable fibers get into the mohair and have to be carefully burled out from the face of the finished goods, which adds to the cost of each piece. A mohair fleece should be simply rolled up without twine of any description. You never see it on Turkey or Cape mohair.

If mohair producers insist on the use of twine, the quality should be hard and smooth, so that no particle of it will adhere to the mohair when it is cut away.

As to assorting the fleeces with reference to the quality of the mohair, no common practice is followed by producers. Some assort them at shearing time and pack in separate sacks, while others pack all sorts together. If the producer is a good judge of mohair, the former method will prove more satisfactory. When all are packed together indiscriminately, the poorer grades of fiber tend to reduce the average price of the whole lot. However, many prefer to pack thus indiscriminately, leaving the work and judgment of assorting to the commission merchant. Most of the mills purchase from the commission merchant because of his skill in assorting.

There are appended some opinions on this subject of Mr. Hoerle which are worthy of consideration:

> Before folding up the fleeces they should be carefully assorted, if this is possible, in the following way:
>
> A. Combing hair, or all hair over 4½ inches in length:
>   1. The very finest, as fine as fine kid hair.
>   2. Next finest, or average run of good doe fleeces.
>   3. General run of fair doe and good wether fleeces.
>   4. Coarse fleeces.
>
> B. Carding hair, or less than 4½ inches long:
>   1. Fineness of class 1 above.
>   2. Fineness of classes 2 and 3.
>   3. Coarse fleeces.
>
> At shearing time fleeces of similar quality and length should be packed together, and special care should be taken not to allow tag ends and burrs to remain in the fleeces. The latter should be carefully picked out before the shearing begins and the former pulled off before packing and placed in a special bag, and marked separately. It is much more profitable to have small lots of low-priced short ends and tags and to pull out with the burrs a few strands of the mohair than to have an entire clip depreciated by careless shearing and packing.

SHEDDING.

The question of shedding is provoking much discussion among goat raisers at this time. Some maintain that the goats shed regularly, while others assert that the purebreds and best thoroughbreds do not shed at all. The correspondence of the Bureau shows that practically all of the goats in this country shed their fleece, either annually in the colder localities or semiannually in the warmer climates. The question submitted by the Bureau was, "Do thoroughbreds shed if not sheared?" There were many positive affirmative replies received and several modified answers. Among the latter are reasons why some goats do not shed. It will be of interest, and probably of some profit, to consider some of these replies in any effort toward reaching a conclusion regarding this question, and they are given herewith:

They will all shed in the spring, when warm weather begins, but the higher they are bred up the longer they will go without shedding.—*H. T. Fuchs, Tiger Mill, Tex.*

Some will shed. I regard the nonshedding Angora as a distinct type, and all the various crosses will retain their fleece.—*William L. Black, Fort McKavett, Tex.*

I have goats that never shed, but they are fed for show purposes during winter. If ordinary care is given, they shed.—*Abe Blackburn, North Yamhill, Oreg.*

I have had goats that did not shed at 1 year old, but did at 2. I think feeding conditions are responsible for such cases.—*George A. Houck, Eugene, Oreg.*

Goats of second cross sometimes do not shed. Depends on condition of goat.—*U. S. Grant, Dallas, Oreg.*

Many thoroughbreds will shed, and we have grades that do not. Much depends upon the physical condition of the goat. If it is in poor flesh and fattens rapidly in spring, it is very apt to commence shedding, just as many sheep do under similar conditions.—*W. G. Hughes & Co., Hastings, Tex.*

Though most breeders in this country disagree with me in my nonshedding views, I am supported by the Cape breeders. One of them, Mr. R. C. Holmes, is very decided in his expressions. He says: "With regard to well-bred goats shedding their hair, I quite agree with you that they should not do so. In fact, among my goats it is an exceptional thing to see a goat shed, and even the ewes at kidding time do not shed. At this period some few may do so, but very few indeed, and a ram should never shed." This does not lack in clearness. Angoras will sometimes lose their hair from disease, a change of climate, or a change of weather even, or a sudden change from a continued dry food to green food, etc. This may appear at any time of the year, regardless of the season, and has absolutely nothing to do with the yearly shedding of low-bred goats. No yearly shedder should be classed as a thoroughbred."—*G. A. Hoerle, Ridgewood, N. J.*

Under certain conditions they will shed, but not if the goats are in good health.—*E. A. Hinkle, Roseburg, Oreg.*

I have about fifty head of nannies that do not shed, but most goats shed if not sheared.—*G. M. Scott, Malta, Idaho.*

DISEASES AND OTHER ENEMIES.

Goats are less subject to disease than sheep; but these species are so closely allied that treatment in cases of disease is the same for both. Several accounts have been published in the agricultural press of goats in the Southwest being affected with stomach worms and with grub in the head, the same as sheep are affected in the same localities. There are occasionally outbreaks of disease in certain localities, but these are due to local causes, and generally have not been difficult to overcome.

The treatment recommended for the screw worm is as follows: Add to any one of the carbolic sheep dips 10 per cent of chloroform. Apply this mixture, after thoroughly cleaning the wound, with a wad of cotton. The chloroform immediately destroys the larvæ and the carbolic dip prevents the further blowing of the wound.

The stomach worm (*Strongylus contortus*) is the same form as found in sheep, cattle, and deer. The treatment in all cases is the same as for sheep.

Goats have at least three kinds of scab parasites peculiar to their species, but apparently only two kinds of scab develop. Psoroptic scab of sheep does not develop disease upon them, though it can undoubtedly sustain life for a while.

Tapeworms of the genus Moniezia are found in goats. In the intestines are also found five round worms, namely, *Strongylus filicollis*, *Œsophagostoma venulosum*, *Sclerostoma hypostomum*, *Uncinaria cernua*, and *Trichocephalus affinis*.

Verminous pneumonia of sheep also occurs in goats.

Tuberculosis is so rare in goats that every case is recorded, the number of such cases being less than a dozen. It may be said, therefore, that they are practically immune from this widespread and insidious disease.

Goats are apt to have foot rot, but a cure is easily effected by the use of sulphate of copper (blue vitriol). It is usually applied by driving the goats through a trough containing a solution of strong blue vitriol. The solution should be about an inch in depth. Oscar Tom, a breeder of much experience, says:

> Butter of antimony applied with a stiff feather will cure it, or mix 1 ounce of sulphuric acid with 2 ounces of vinegar and apply as above. Go over the whole band. Generally one application cures if well done. Change the range at the same time if you can.

Angoras are frequently affected with lice, which cause a loss of mohair from the rubbing and scratching of the goat. The lice may be exterminated by dipping. The common sheep dips are generally used for the purpose. It is a common practice to dip the goats once a year, and some advise dipping twice a year—in spring just after shearing and again in the fall.

One of the principal enemies of the Angoras is the wolf. The best guard against wolves is a good wire fence. Sometimes the wolves dig under the fence, and then it becomes necessary to trap them. This is practiced by Mr. H. T. Fuchs, who says:

> Three steel traps are fastened to each other, but to nothing else, and catch the wolves. If the trap is made fast the wolf will break loose, but the weight of three traps fastened together simply tires the wolf out, and it rarely drags them more than 200 or 300 yards.

In many localities the wildcats are especially troublesome. Their prey is the kids.

The fact that many plants which are poisonous to sheep and cattle may be eaten with impunity by goats is frequently referred to by writers for the press. It is true, however, that goats sometimes die from eating poisonous plants, especially in the mountainous districts of the Carolinas, as the Bureau is informed through correspondence. The so-called "ground ivy" is specially referred to. It is believed that goats will not eat poisonous plants to an injurious extent unless driven by hunger to do so.

NUMBER OF ANGORA GOATS.

IN THE UNITED STATES.

The census reports previous to the year 1900 have not given the number of goats in the United States; the Twelfth Census, however, will show the number of Angoras, as well as the number of common goats.

Col. William M. Black, of Fort McKavett, Tex., in 1898 estimated the total number (including all grades) to be 247,775, located in States and Territories as follows:

Texas	75,000	Tennessee	250
California	59,000	South Carolina	200
New Mexico	52,000	North Carolina	200
Oregon[1]	15,000	Colorado	200
Nevada	11,500	Mississippi	150
Idaho	8,000	Louisiana	150
Wyoming	7,000	Connecticut	150
Arizona	5,700	Alabama	75
Missouri	5,200	Arkansas	75
Utah	2,000	Florida	75
Montana	1,500	Iowa	75
Kansas	1,200	Virginia	75
Indian Territory	900	Nebraska	50
Georgia	750	Washington	50
Kentucky	500	West Virginia	50
Pennsylvania	400		
Illinois	300	Total	247,775

About a year later Mr. William R. Payne, of New York, estimated the total number at 300,000. If these estimates are anywhere nearly correct, the present number must be very much greater, probably as many as 400,000.

IN CAPE OF GOOD HOPE.

Mr. W. Hammond Tooke, in the Agricultural Journal of the Cape of Good Hope for May 25, 1899, gives the number of Angora goats for 1893–1898 as follows:

1892–93	2,811,206	1895–96	2,546,981
1893–94	2,619,708	1896–97	2,685,080
1894–95	2,611,082	1897–98	2,982,811

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[1] A home authority estimates the Angoras in the State at 65,000.

IN ANGORA VILAYET.

Schreiner estimated that the number of Angoras in the vilayet of Angora in 1894, was 1,230,000. He also directs attention to the fact that the mohair area of Turkey in Asia extends beyond that province.

PRODUCTION OF MOHAIR.

The quantity of mohair of all grades produced in the United States has been a matter of guess, and the estimates have been wide apart. Assuming that practically the entire domestic product goes to the mills for fabrication, the Bureau addressed to the mills that consume mohair a request to be furnished a statement of the amount of domestic and imported mohair used annually. It is believed, therefore, that these statistics which are given herewith represent the total product of the United States for the year 1899:

Consumption of mohair in the United States in 1899.

Mills.	Domestic.	Imported.
	Pounds.	*Pounds.*
Sanford Mills and the Goodall Worsted Co., Sanford, Me	840,000	460,000
Tingue Manufacturing Co., Seymour, Conn	....	15,000
Atlantic Mills, Providence, R. I	....	[1] 296,465
Gold Medal Braid Co., Attleboro Falls, Mass	....	1,000
Massachusetts Mohair Plush Co., Lowell, Mass	200,000	300,000
Westfield Braid Co., Westfield, Mass	....	[1] 8,000
Cranston Worsted Mills, Bristol, R. I	32,000	39,000
Queensbury Mills, Worcester, Mass	5,000	....
Total	1,077,000	1,119,465

[1] Not certain it was imported mohair, but assumed to be.

The customs figures of the Cape of Good Hope, as quoted by W. Hammond Tooke, show that mohair was produced there for various years previous to 1898 in the following amounts:

	Pounds.		Pounds.
1877	1,433,774	1894	10,003,173
1882	3,766,657	1895	11,090,449
1887	7,153,730	1896	10,001,028
1892	10,516,837	1897	12,583,601
1893	9,457,278		

According to Commercial Relations for 1899 the entire product of the Cape of Good Hope for 1897 was exported, as well as that for 1898, which is given as 10,876,014 pounds.

It has not been possible to obtain figures showing the production of Turkey for any specific year or for a series of years, but the average annual production is frequently given as 7,650,000 pounds.

TARIFF.

The act approved July 24, 1897, places a duty of 12 cents per pound upon mohair. Mohair cloth for buttons is taxed 10 per cent ad valorem. The duty on dressed and finished goatskins is 20 per cent ad valorem; on skins for morocco, tanned but unfinished, 10 per cent ad valorem. These rates are subject to increase under certain conditions of shipments.

REGISTRATION ASSOCIATIONS.

The Bailey Angora Goat Registration Association, of San Jose, Cal., has kept a private register for many years, and became a general record association in 1898.

There are two registration associations in the United States which were organized during the year 1900—the American Angora Goat Breeders' Association, with headquarters at Kansas City, Mo., and the National Angora Record Association, with headquarters at Salem, Oreg.

LITERATURE CONSULTED.

The principal works consulted in the preparation of this paper are as follows:

SCHREINER, S. C. CRONWRIGHT:

The Angora Goat (published under the auspices of the South African Angora Goat Breeders' Association). Longmans Green & Co., London, New York, and Bombay. 1898. Pp. 256, figs. 22.

HAYES, JOHN L.:

The Angora Goat: Its Origin, Culture, and Products. American Agriculturist, New York. 1882.

HOOK, BRYAN:

Milch Goats and their Management. Vinton & Co., Limited, London. 1896. Pp. 115, figs. 17.

HOERLE, GUSTAV A.:

The Angora Goat: Its Habits and Culture. Fink & Co., Leon Springs, Tex. 1886. Pp. 32.

JOBSON, E. H.:

Angora Goat Raising. E. H. Jobson, Lake Valley, N. Mex. 1900. Pp. 29, fig. 1.

ALLEN, GEORGE EDWARD:

Angora Goats: The Wealth of the Wilderness. Horace A. Field & Co., Wellsboro, Pa. 1900. Pp. 32, fig. 1.

C. P. BAILEY & SONS CO.:

California Angoras. San Jose, Cal. 1900.

Besides these access has been had to hundreds of articles in the agricultural press. Special mention should be made of the Oregon Agriculturist, Portland, Oreg., the Pacific Rural Press, San Francisco, Cal., and the American Sheep Breeder, Chicago, Ill. The two latter devote a page regularly to the goat industry.

The library force of the Bureau of Animal Industry have prepared a bibliography of goat literature, but the titles are so numerous that it has been deemed advisable to hold them for separate publication rather than to append them here.

VERMINOUS DISEASES OF CATTLE, SHEEP, AND GOATS IN TEXAS.

By Ch. Wardell Stiles, Ph.D.,

Zoologist of Bureau of Animal Industry.

The attention of this Bureau was first called to certain losses among the live stock of Texas, caused by parasitic worms, by a communication from Dr. William Folsetter, of Dallas. A few months later the writer visited Texas upon the request of Congressman Kleberg, in order to investigate an outbreak among young cattle reported in Dewitt County. The investigations were interrupted by an unforeseen accident, but were supplemented some months later during a visit to Victoria County. While the work is not yet completed, it is sufficiently advanced to warrant a preliminary report, which is here submitted.

NATURE OF THE OUTBREAK.

The cattle, sheep, and goats in the counties visited were found to be suffering from a disease which the stockmen called "scours," the name being taken from the most prominent symptom, diarrhea, noticed in the final stages of the malady. Different cases presented different clinical pictures, but all seemed to agree more or less closely in the final symptoms, and this fact had given rise to the popular idea that all were suffering from the same disease. These final symptoms were extreme emaciation, edema of the throat (swelling under lower jaw—known popularly as "water jaw," or "poverty sack"), severe diarrhea, staring coat, dull, sunken eyes, drooping ears, great weakness; at last the animals were too poor and too weak to rise, and death soon followed.

It is needless to say that almost every stockman had his own ideas as to the cause of the trouble. Among the most commonly accepted explanations of the malady may be mentioned lack of food, continued wet weather, and "sour grass."

Before I had examined any cases, Dr. Folsetter had made a careful examination of one herd, and had performed a number of autopsies. He has submitted to me an interesting account of his observations, which is here printed in full:

> On Friday, the 8th of December, 1899, I was called to Harris County, Tex., to examine a herd of 1-year-old steers that were in some way diseased, about 100 having died and another hundred or more showing signs of being affected with the same disease. The original number purchased was about 2,000, ranging in age from

9 to 15 months. Some were bought through a New Orleans commission firm, some came from near New Iberia, others from Rayne, and some from Mississippi and southeast Texas. They were all purchased about the first week in July, 1899, and placed in a 9,000-acre pasture divided into five pastures by wire fences, all the pastures adjoining each other and connected by gates. The pasture is level prairie with plenty of grass, known as "sage grass." This is a coarse, rough grass that covers the ground in a dense growth. The natural drainage is very poor, and very little has been done in the way of artificial drainage, so that when it rains a great deal of water stands on the surface of the land for days, or until it is absorbed or evaporated. The soil is black and tenacious, and inclines to hold water well. The pastures also contain what are known in Texas as "hog wallows;" that is, every 10 feet or so there is a small depression of 4 or 5 feet in diameter and 6 or 8 inches deep, with a corresponding elevation, making a difference of about a foot. When it rains these hollows fill with water which is retained until it evaporates or sinks into the ground. From these little pools the stock drink constantly when grazing around. This ranch is unusually well watered artificially by a large artesian well, from which pipes lead into the different pastures; there are also some half dozen wells with windmills attached to them; these wells are so arranged that the stock do not have to travel over half a mile in any of the pastures to reach fresh water in unlimited quantities. The water from these wells is in every case discharged into wooden troughs, which are kept full at all times by float valves, and are regularly cleaned out every week or two; but in spite of this the cattle will drink from the surface pools. The greatest care has been given to the health of this stock. The ranch is managed by an all-round stockman who is a wide-awake, thorough-going business man. He has had experience with stock in other Western States besides Texas; has raised, grazed, fed, bought, sold, and shipped cattle for a number of years, and is familiar with range stock in health and with the ordinary diseases that affect such stock. This herd has had his personal attention.

Shortly after purchasing this stock and turning them into the pasture the animals were attacked by an infectious inflammatory disease of the eyes, commonly called "pink eye," which gave them a setback, and for some time they did not do well. This occurred in July, and in August he lost some 25 head with what he considered charbon. After this he noticed that a number of them were looking bad, and along in October he began to lose one occasionally, until about the 25th of November, when Dr. W. A. Knight, a veterinary surgeon, of Houston, was called in to make an examination of the herd and to decide the cause of the trouble. The doctor held four postmortems. In two of the subjects he found liver flukes (*Fasciola hepatica*); in the other two they were absent, but in all four he found *Filaria micrurus*—the hair lung worm. Some remedies were tried, but with no noticeable benefit. The disease being recognized as more or less of an infectious character, the State sanitary board was called on, and I was sent to make an investigation and report. I arrived in Houston on the morning of December 8, and in company with Doctor Knight and the manager drove directly to the ranch. We found about 100 yearling steer cattle in a lot large enough for their accommodation, with plenty of shelter sheds, an abundance of clear, pure water supplied by windmill from a well; the racks were full of good hay, cotton-seed meal, and cotton-seed hulls. The cattle were feeding well and chewing their cuds, but appeared to be in very poor condition, listless, did not want to move, had dry, staring coat, haggard look, and a glassy, staring appearance of the eyes, very little cough, but at long intervals one would be heard to give a short, husky cough. Three had died during the night, and we killed two others that were so far gone as to be unable to stand when helped up. We helped some six or eight that were unable to get up by themselves, and when assisted to their feet they walked off, and some went to feeding. The discharge from the bowels was, as a rule, of a brownish color and of a normal consistency, but some two or three showed a tendency to a looseness of the bowels; only about three, so far as I have observed, showed any tendency to reach a diarrhea. We held postmortems on five head. In four of them there was more or less disease of the liver present, caused by flukes; in one there was no sign whatever of any disease in the liver; otherwise, the postmortems of all five might be said to be identical, and a description of one will answer for all.

On removing the skin the cellular tissue all over the body is filled with a clear, watery fluid, especially in the submaxillary space and on the brisket. On opening the abdominal cavity a quantity of pale, watery, slightly straw-colored fluid is seen. The spleen is normal.[1] The urine, when present in the bladder, has a normal appearance; kidneys normal; an entire absence of anything bearing the slightest resemblance to fat, even in the sockets of the eyes. The blood is watery and hardly leaves a stain on the hand; the small bowels are pale and almost transparent, with scarcely anything in them but a little mucus; the rectum sometimes contains a little feces. The stomach contains more or less food, to all appearances fairly well digested as it has progressed through the different divisions, and appears normal in the several compartments of the stomach. On opening the thoracic cavity and removing the heart and lungs, the muscular fiber of the heart is found to be pale in color, and soft and flabby to the touch, and on opening it more or less clots are present, and in some cases well-organized yellow clots; these we find especially in the left auricle, extending into the left ventricle, and fixed in the valves dividing them. The lungs are paler in color than normal, and in running the finger over the surface well-defined nodules of different sizes are found below the surface of the pleura. Portions of both lungs are found collapsed; in some cases a good deal of one or both has become solidified or hepatized; in many instances the anterior apex of the right lung is adherent to the walls of the chest, and also to the pericardium. The posterior lobe often contains a solid area; on sections in some places it is of a uniform grayish color; in other cases it is more reddish and mottled with grayish green spots, and on being squeezed a large quantity of a frothy serum is pressed out of it. Following down the several branches of the bronchial tubes a greater or less number of worms, known as *Filaria micrurus*, are found; in some cases only a few worms are found, in others thousands are present; and the surprise is that, owing to their immense numbers, there is not a greater pneumonic condition of the lung. These worms extend down into the smaller broncheoles, collect in masses, and plug up the air tubes, thus producing the hepatization. Around the worms are large quantities of a gummy, gelatinous mucus, which adheres to the bronchial tubes and also to the worms; this no doubt helps to retain them in the air tubes, preventing them from being expelled when the animal coughs; it also appears to be soothing to the lung and prevents the worms from producing any irritation when wandering around in the air tubes. Further, the mucus mass also contains large numbers of eggs in all stages of maturity, also newly hatched worms; but no medium-sized, immature, or half grown worms are found. From the time they seem to leave the eggshell until they are fully grown and matured, they seem to be absent from the lungs. They are male and female, and mate in the lungs. The male is easily recognized from the female by its size, shape, and the difference in the tail; the male is only about two-thirds the size of the female; the females are always very full of eggs, each female containing thousands of eggs in all stages of development; the frothy mucus in the bronchial tubes is also loaded with eggs. In many instances a fully matured worm seems to have crawled into a small bronchial tube and entirely plugged it up, thus causing a collapse and solidification of that portion of the lungs. In some cases the worms are dead and one end will be found extruding from the mouth of the tube; this end may appear normal, but when the worm is pulled out, the other end will be found to have softened and become a disintegrated mass and undergoing changes in the hepatized portion of the lung.

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[1] In most of the postmortem examinations which I have made the spleen was contracted.—C. W. S.

From what I heard before going to Texas I expected to find conditions in the herds I examined similar to those described by Doctor Folsetter, and hence was prepared to deal with verminous bronchitis. It soon developed, however, that, although some animals presented severe infections of lungworms, other animals in equally poor condition showed but light lung infections. Examination of different herds then proved that the outbreak was not a simple disease, but a compound malady, varying not only in different herds, but in some instances also among the animals of the same herd.

I will not assert that I have exhausted the subject, and that there are no factors involved which I have not yet recognized, but the conditions met with appear to be amply explained by the enormous numbers of animal parasites found, not only in the cattle, but also in the sheep and goats. This heavy infection of worms is due to several causes:

First. The wet weather during the past two years has brought about conditions which have been very favorable to the development of worms, and a recurrence of the trouble may be expected in wet years in the future.

Second. It is due to the failure properly to drain and systematically burn the pastures, hence the dangerous conditions caused by the wet weather have not been overcome, and the germs in the pastures have not been killed.

Third. It is due in some cases to a failure to provide proper watering facilities for the stock, the animals being forced—or if not forced at least permitted—to drink from stagnant pools, thus increasing the infection.

Fourth. It is in some cases increased by overstocking pastures.

Fifth. It has been increased by a failure to isolate diseased animals from the healthy stock. Thus the sick animals have spread the infection in the pastures where healthy animals were feeding.

The explanation offered by some stockmen that the trouble is due to "sour grass" does not apply to the cases I have examined. The explanation that the outbreak was due to wet weather is in a measure correct, for the wet weather brought about conditions which were favorable to the development and spread of the parasites.

THE DIFFERENT PARASITES FOUND.

As stated above, the cases observed were complex, not simple. In other words, there was not one specific parasite which caused all cases, but a number of different worms. This important truth explains several facts which have been quite generally misunderstood, and also warns us regarding certain matters which will be noticed in the future.

Not infrequently stockmen were met who claimed to have cured sick nimals which were in a condition corresponding to those I examined. Other stockmen had used the same remedies and had failed to effect a cure. In my own experiments I had very satisfactory results in some cases, yet when the same remedies were tried on other animals I could notice no improvement. The lack of uniformity in these results is easily explained by the presence of different parasites in different animals, yet a positive antemortem diagnosis as to exactly which parasites were injuring a given animal was in most cases impossible.

Taking all of the cases together it may be stated that the animals were suffering from—

I. Verminous gastritis (worms in the fourth stomach), or
II. Verminous enteritis (worms in the bowels), or
III. Verminous bronchitis (worms in the bronchial tubes), or
IV. A combination of all three, or any two of these.

1. VERMINOUS GASTRITIS (WORMS IN THE FOURTH STOMACH).

CATTLE.—In the fourth stomach of cattle two different kinds of worms were found—the common twisted wireworm and Ostertag's encysted wireworm.

(1) *The common twisted wireworm (Strongylus contortus).*

This worm was found in about one-third of the cattle examined. In some cases only a few specimens were present, and I was not inclined to attribute much importance to them. In other cases they were more numerous and were evidently important factors in producing disease. This was notably the case in two calves and in two sheep which were examined postmortem. In these four animals the fourth stomach, when opened, was seen to contain hundreds of the parasites.

This wireworm, which is common in many parts of the United States, is about an inch in length, its diameter being about the same as that of an ordinary hairpin. It is readily seen with the naked eye, and receives its popular name "twisted" from the coiled position of its internal organs, which give it a peculiar appearance, much like the stripes of a barber's pole or the spiral of a corkscrew. It lives free in the lumen of the stomach. Doctors Folsetter and Knight found this same worm in great numbers in animals which they examined.

Treatment.—(See p. 369.)

(2) *Ostertag's encysted wireworm (Strongylus Ostertagi).*

This worm is much smaller than the twisted wireworm, and is ea overlooked. In fact, the chances are against its being discov unless one's attention is especially called to it. It is less than hal inch long and about as thick as a fine hair. Occasionally it is f tomach, but usually it is met with encysted in the w stomach is cut open, numerous very nodules with minute openings are observed. It is in these nodules that the worms live. By passing the finger or the blade of a knife over the surface of the lining membrane of the stomach the cysts are broken and the worms are pressed out, either entire or in part.

This parasite was found in every calf, steer, and cow examined on postmortem during my second trip to Texas. Although the worm is small, I can not escape the conclusion that it was the chief factor in the disease found among the cattle. In many cases the stomach wall was literally studded with these parasites, so that a portion of the stomach when placed under the microscope reminded one of a very heavy infection of muscular trichinosis in man, hogs, or rats. The presence of so many worms in the stomach wall was naturally a serious factor in preventing a proper digestion of the food, and in many cases amply explains the fact noticed by so many stockmen that, no matter what food was given to the steers, they failed to improve. A description of conditions occasionally met will sound incredible; yet it is a fact that the stomach wall is sometimes found to be so infested with these worms that it is half an inch to one inch and a half in thickness, and appears like a mass of rubber which has been in xylene for a long time. Technically speaking, the stomach wall is edematous, and slight pressure with the hand suffices to cause a large quantity of watery fluid to flow from it.

The worm in question was originally described by Professor Ostertag in Berlin, and has since been named after him.

Treatment.—I regret to state that all my experiments to kill this worm must be looked upon as failures. The problem before us is to introduce into the stomach some substance which will be absorbed by the stomach wall and will be strong enough to kill the worm yet not injure the cattle. At the present moment I see no outlook for a successful solution of this difficult problem.

Prevention.—(See p. 377.)

SHEEP.—In the fourth stomach of sheep, also, two worms were found. One was the twisted wireworm (the same species which was found in cattle), and the other was a smaller wireworm (*Strongylus vicarius?*) similar to, yet different from, Ostertag's wireworm. This parasite has not yet been definitely determined. It was found but once and in small numbers.

GOATS.—No postmortem examinations of goats were made, but from microscopic fecal examinations which were made, from the general symptoms noticed, from the fact that sheep and goats were running together, and finally from the results of experiments in treatment, I have little doubt that the goats were suffering from the same parasites that were found in the sheep.

II. Verminous Enteritis (Worms in the Bowels).

Cattle.—Two worms in particular were found in the bowels of cattle; one species, the hookworm (*Uncinaria radiata*), near the stomach, and a second species, the nodular worm (*Œsophagostoma columbianum*), lower down.

(*1*) *The hookworm* (*Uncinaria radiata*).

The hookworm was found in about half the cattle examined on postmortem, but it was usually present in small numbers, and with the exception of one or two cases it appeared to be doing little harm. On the first trip to Dewitt County it was met with in greater numbers and appeared to be of greater importance. This parasite is about an inch long and is somewhat thicker than the twisted wireworm. It is usually more uniform in color, frequently a chalky white, and may be easily recognized without the aid of a microscope.

Treatment.—(See p. 369.)

(*2*) *Nodular disease* (*Œsophagostoma columbianum*).

Nodular disease of the bowels is well known to most stockmen. Some persons consider it a very serious malady, but my own observations lead me to believe that, in general, its importance has been somewhat overestimated.

Treatment.—The nodules can not be cured, but the adult worms can be expelled by the same treatment used for *Uncinaria*. (See p. 369.)

Sheep.—In sheep three worms were found in the bowels—(1) a hookworm (*Uncinaria cernua*); (2) the nodular worm; (3) the fimbriate tapeworm.

(*1*) *The hookworm* (*Uncinaria cernua*).

This worm agrees approximately in size with the hookworm of cattle, but is usually much darker in color and is found more in the middle portion of the small intestine. It was found in very large numbers in two different flocks of sheep and appeared to be doing more harm than all the other parasites of the sheep.

Uncinaria is one of the most dangerous genera of parasitic worms. In man, for instance, we have a serious disease (uncinariosis) caused by one of the species of this group.[1] Another *Uncinaria* causes a high mortality in young dogs. A third species (*U. Lucasi*) is responsible for about 17 per cent of the death rate of the seal pups of Alaska.

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[1] Since the above account was written ten cases of this disease, caused by *Uncinaria duodenalis*, have been diagnosed in man in the United States. One case was diagnosed by Dr. Clator, of Washington, D. C., in a native-born farmer boy from Virginia; one case by Dr. Allyn in an Italian immigrant in Philadelphia, and eight cases by Dr. Allen J. Smith among the medical students in Galveston, Tex. In thirteen fecal examinations made in July, 1901, by Dr. Hugh Crouse and myself at Valley View Hospital, Victoria, Tex., this parasite was not encountered.

Other members of this group are found in cats, tigers, and hogs. The genus is characterized by having its head turned backward, so that its mouth appears to be on its back; and wherever we meet with these forms we find them doing serious damage, for they are blood suckers of the worst sort.

Treatment.—(See p. 369.)

(2) *Nodular disease* (*Œsophagostoma columbianum*).

This parasitic disease was found, on postmortem, in the sheep of Victoria County.

(3) *The fringed tapeworm* (*Thysanosoma actinioides*).

In several sheep examined after death, fringed tapeworms were found in the intestine and in the ducts of the liver. I was unable to convince myself that they were doing very much harm in the particular cases which came under my observation, but no cases of heavy infection were encountered.

Treatment.—Many remedies for tapeworms in sheep are proposed, and among these arsenic is especially highly praised. Arsenic proved absolutely useless in expelling the fringed tapeworm from the intestines.

GOATS.—From what I saw in Victoria County I believe that *Uncinaria* was present in the goats, but no postmortems were made to confirm this view. From a herd of goats which I did not examine personally the owner sent me a large number of tapeworms belonging to the genus *Moniezia*.

III. VERMINOUS BRONCHITIS (WORMS IN THE BRONCHIAL TUBES).

In cattle the small-tailed lungworm (*Strongylus micrurus*) was found, while the thread worm strongyle (*Strongylus filaria*) was met with in sheep.

Lungworms in cattle (*Strongylus micrurus*).

Reference has already been made (see above p. 356) to the cases of lungworm infection of cattle found by Drs. Folsetter and Knight. I found similarly heavy infections in Dewitt County. In Victoria County this same parasite was present in most cases which came to autopsy. In two calves it was present in large numbers, and appeared to be doing considerable injury, as there was quite a general hepatization of the lung tissue immediately surrounding the air passages. In most cases, however, the lungworm infection appeared to me of secondary importance. Even with a moderately severe infection the pathologic changes in the lungs were entirely out of proportion to the severe symptoms.

The worms in question are 2 to 4 inches long, whitish in color, with the diameter of a steel knitting needle or hat pin. They are easily found by cutting open the bronchial tubes.

Treatment.—(See below.)

Lungworms in sheep (*Strongylus filaria*).

In several sheep which were dissected lung worms were found in considerable numbers, and these appeared to be doing more damage than the corresponding worms in cattle.

Treatment.—(See below.)

TREATMENT OF LUNGWORM DISEASE.

According to generally accepted views among veterinarians and zoologists, it is a comparatively simple matter to kill worms in the bronchial tubes, and a number of cases of the disease are reported in literature which are alleged to have been cured. The experience of Drs. Folsetter and Knight and of myself have not borne out the view that treatment is either simple or successful.

Neumann (1892b, pp. 590, 591, 593, 594) summarizes the subject of treatment as follows:

> Two different procedures in treatment are pursued. In one, substances are passed into the digestive canal, which, being diffused in the blood, are believed to be capable of attacking the worms in the bronchial tubes. With this view, the picrate of potash (0.20 to 0.40 gram per head) is given, dissolved in thin gruel or mucilage; creosote; oil of turpentine; a mixture of equal parts of oil of turpentine and tincture of camphor—a teaspoonful every day to each lamb in a mucilaginous fluid; a mixture of creosote 120 grams, spirits of wine 500 grams, and water 700 grams—an ordinary spoonful every day to each animal; or creosote 60 grams, benzine 300 grams, water 2 liters—an ordinary spoonful given every day for eight days to each sheep. Hall states he has successfully employed prussic acid in 10-drop doses, morning and evening.
>
> But experience has shown that, while such treatment is troublesome to carry out, its efficacy can not be relied upon.
>
> Success is more certain with fumigations, as they penetrate directly to the worms, stupefy them, and induce fits of coughing that cause expulsion. They are practiced in buildings from which all forage is previously removed, and which are well closed. Into these the diseased [animals] are introduced, and on a red-hot shovel are placed rags, horns, feathers, hair, old pieces of leather, empyreumatic oil, tar, juniper berries, asafetida, etc. The intensity, duration, and number of these fumigations are graduated as the sheep become accustomed to them. At first, once a day may suffice, and then the intensity should be moderate and the duration about ten minutes; afterwards two, and finally three, may be given during the day, each lasting for twenty minutes. Kowalewsky says he has obtained very good results from similar fumigations. Fumigations with chlorine, sulphur, and sulphuret of mercury or cinnabar have been recommended, but they are dangerous.
>
> (Stephen recommends as follows: Put about forty lambs at a time into an air-tight house, and place tar, sulphur, and turpentine in a pot of burning coals, suspended by a chain from the ceiling and brought as near to the heads of the animals as possible; the fumes are to be allowed to fill the house, and more ingredients are added as

required, the lambs being kept in the place for twenty-five minutes each time, and the process to be repeated on three occasions.)

Tracheal injections in the verminous bronchitis of calves are of great utility; but for a flock of sheep they would be troublesome and difficult to administer. However, Nieman has successfully employed them on 384 sheep belonging to several small owners. He used a solution of 2 parts iodine and 10 parts iodide of potassium in 100 parts of distilled water. This fluid was mixed, in equal parts, with oil of turpentine, and made into an emulsion with olive oil; each sheep received 5 to 8 grams of the mixture, and the number of the injections varied according to the gravity of the disease—from 2 to 3 at two days' intervals. The worms were killed and expelled during the paroxysms of coughing, and the bronchitis was modified.

The medical treatment should be assisted by very nourishing food, and by bitter, stimulating, and ferruginous tonics, which arouse the digestive functions and allow those animals which are least exhausted to reach the period of elimination of the parasites.

At the commencement of any kind of treatment it is well to have an examination of the flock, with the object of sending the worse cases to the butcher.

The same medicaments have been employed in treating this malady in calves as in that of sheep, and no better results have been obtained. Numann and Janné have, however, been successful with asafetida (30 grams), Chabert's empyreumatic oil (60 grams), and a mucilaginous decoction (500 grams)—a spoonful of this mixture being given in a half liter of milk, and the treatment continued for about a month.

The results are less uncertain if the worms lodged in the bronchial tubes are directly acted upon, either by means of injections of the same kind as those employed for sheep, or fluid medicaments introduced directly into the bronchi.

Read says he has cured calves worn down almost to skeletons by verminous bronchitis by the following procedure: The head of the calf is slightly elevated, and about two drachms of ether, chloroform, oil of turpentine, or rectified oil of amber—single or combined—are poured into each nostril and allowed to vaporize there; it will then, by the respiration, be carried into the air passages, and thus destroy the filariæ. In some cases it must be repeated two or three times, but once has frequently the desired effect.

The method of treatment by intratracheal injection, introduced by Levi, of Pisa, has yielded very satisfactory results. Levi has been completely successful with a sheep. Éloire has employed it in 16 calves affected with the disease, and all were cured. He used the following mixture: Black poppy oil, 100 parts; oil of turpentine, 100 parts; carbolic acid, 2 parts; purified cade oil, 2 parts. Each calf received 10 grams of this mixture daily for three days.

The injection, which should be given slowly, is followed by a fit of coughing, and the expired air has the odor of turpentine. This treatment has also been successful at Milan. Similar favorable results have followed Hutton's treatment of 8 calves, some of which were in the last stage of verminous bronchitis. He employed a mixture of oil of turpentine, tincture of opium, pure carbolic acid, and water—the oil of turpentine forming one-half of the mixture. The dose was half an ounce, and in the serious cases this was given every day for three days, and in other cases every second or third day. Kriwonogow has likewise cured 22 calves by giving each of them two tracheal injections of 8 grams of the following mixture: Essence of cloves and oil of turpentine, 360 parts of each; carbolic acid and olive oil, 30 parts of each.

(Williams speaks highly of the administration of prussic acid. Penhale gives—by intratracheal injection, and slowly—oil of turpentine 2 drams, carbolic acid 20 minims, and chloroform half a dram.)

The following account of the experiences of Drs. Folsetter and Knight has kindly been furnished me by the former:

> After freely discussing the various remedies and forms of treatment advocated by the different authorities on the subject, we decided to try first the intratracheal injections, and we chose oil of turpentine as the most likely to be attended by the best results. We selected one of the weakest animals—one that had to be assisted to rise to its feet—and injected 2 drams of turpentine into its trachea. After waiting some twenty minutes and finding that it produced no special uneasiness, we tried another, and then another, until we dosed 25 steers in the same way, with apparently no ill effects on the cattle. Some coughed a little, others not at all; some were given the medicine standing up, others were laid down. The needle of a veterinary hypodermic syringe was pushed right through the skin and rings of the trachea, and then the contents of the syringe were slowly discharged into the windpipe. Sometimes the end of the needle would become plugged with the tissue in the passage through the skin, but this we relieved by passing a small wire through the canal in the needle. On returning to the herd the next morning we found that the animals we had treated were none the worse for the treatment they had received, but two which we had not dosed were dead. I held postmortems on them and found the conditions similar to those already mentioned. In addition to the lung trouble, both showed some signs of flukes having been in the liver. On returning the next day we found them in about the same condition as on the previous day. We repeated the dose of 2 drams of turpentine and the next day they showed no ill effects from the second dose, but no perceptible improvement. On returning the following day we could still see no change for either better or worse, but in the meantime several other animals which had received no treatment had died, all exhibiting about the same postmortem appearance. We then repeated the same dose on those first treated, this being the third dose in six days of, in all, 6 drams of turpentine. We then dosed all the remaining steers, 52 in number. The day was cold, and a raw north wind was blowing. Some ten or a dozen of this lot, after getting their dose and being placed on their feet, staggered, reeled, and fell over, and rolled their eyes as if about to die, and seemed to be quite sick for twenty minutes or half an hour, when they all appeared to recover from the effects. Two animals, however, died almost immediately after receiving their dose. On postmortem examination of one there was an extra amount of frothy mucus in the bronchial tubes; in fact, they were completely plugged with it, the animal having become asphyxiated by it; and the other had a well-organized clot in the right auricle and ventricle of the heart. The next day three of these animals were dead, or nearly so. We killed them and held postmortems; but no ill effects of the treatment were discernible, and the worms were not dead. The next day two more were dead, and we found living worms in the lungs. On going to the ranch the next Sunday morning one was found dead, the first one of the first 25 treated which had died. There were no ill effects of the treatment to be seen, but the worms were alive in numbers. On returning the next day, Monday, a second one of the first 25 was found dead, and on examination of the lungs thousands of living worms were found in the bronchial tubes This convinced me that the intratracheal injection, although highly lauded by some authors, was in this case a complete failure. We then tried turpentine, chloroform, and carbolic acid, benzine, creosote, liquid sulphur, and a 4 per cent solution of formaldehyde, all with the same results. I then began to believe that the liquid, when injected into the lungs, was not thoroughly diffused throughout the lungs but gravitated to the low point, as is natural with all fluids, and in order to decide the point I injected 6 drams of ink into an animal and waited an hour or so; then I killed it by bleeding it to death, and found that, as I had expected, all the ink had followed the course of the lower bronchial tubes. This finally decided the question

of intratracheal injections for the purpose of destroying the parasites in the lungs I would have tried atomizing, but could not obtain an instrument which would work without having one specially made, and that was not practicable at this time. I believe that if atomized the fluid would condense again before reaching all over the lungs.

I then had an air-tight room built, with an observation glass in each side of it. In this room an animal was placed and chlorine gas was generated. To this the steer was subjected for one hour. This caused the animal to cough. I then generated sulphuric acid gas, by placing sublimed sulphur on hot coals, and subjected one animal to the fumes for four and one-half minutes, another one for five minutes, and one for ten minutes. The one that was in ten minutes breathed somewhat hard for twenty-four hours afterwards; the other two did not seem to be any way affected, and none of them either coughed or sneezed. I then placed about 2 ounces of capsicum on the coals with the sulphur, and subjected one animal to it for fifteen minutes. The steer did not cough or seem to be affected in the least. After being out in the air a few minutes he at first slobbered, and tears ran from the eyes. I was advised by a number of physicians, whom I consulted on the subject of the inhalation of the different gases in the human subject, to use formaldehyde gas. I also consulted Dr. Gambeti, a dentist, who has some advanced ideas on its use, and some patents on instruments for its generation and use, but was unable to secure a proper generator to apply it.

In the meantime, Dr. Knight and I had consulted Dr. John Sampson, a skilled microscopist. He had made a microscopical examination of the worms for us, and although he found worms of both sexes and eggs in abundance and in all stages of development, from the egg still in the body of the female to the worm just hatched, there were no half-grown individuals. The question then arose as to what became of them from the time they were hatched till they became fully matured, when he suggested that the eggs and young larval worms might pass down to the nose and be licked with the tongue, a habit that all cattle have, and thus be carried into the mouth and passed into the stomach, and there perhaps undergo some other change similar to the bot fly in the horse's stomach; and he advised searching the intestinal tract thoroughly for any signs of them. I then began a systematic search, and after reaching the fourth stomach without finding a trace of anything resembling a worm, I examined the walls of it with a strong magnifying glass, and found that it was studded with numerous fine red spots like pin points, as if something had bitten it. I then placed some of the contents on a piece of glass, and, on holding it up to the sunlight and examining it minutely with the magnifying glass, I could make out a small worm about a sixteenth of an inch in length. I gave this worm to Dr. Knight, who carried this stomach and its contents to Dr. Sampson, and when portions of it were examined under the microscope the parasites were seen to be present in myriads.

This worm has the appearance of being a bloodsucker, living on the blood of the animal extracted from the small vessels of the mucous membrane lining the stomach, and is no doubt more the cause of the trouble than the *Filaria micrurus* of the lungs. So far, we have been unable to positively identify the worm, and the nearest description that we can find of any parasite in any literature at hand is an account of a disease accompanied with diarrhea in lambs, which is given in the Journal of Comparative Pathology and Therapeutics, I, part 1, March, 1897, edited by Professor McFadyean, of the Royal Veterinary College, London, England.

The cattle are now being fed with hulls and meal mixed with salt and sulphate of iron and sulphur, which is left in quantities before them at all times.

About the 1st of November 94 head of these cattle were taken about 4 miles to a separate farm, where there was plenty of food, shelter, and artesian water. Twelve head of this bunch have died with the same disease, and some fifteen more of them look as if a few more days would end their earthly career. I held postmortems on two of them, and found worms both in the lungs and in the fourth stomach. On November 24 I injected 1 ounce of peroxide of hydrogen into the trachea, with the idea that it might dissolve the mucus that surrounded the worms, which it seemed to do to a certain extent when applied to them outside of the body. Half an hour afterwards I injected 4 drams of a 4 per cent solution of formaldehyde. The next morning this animal showed signs of pneumonia; temperature 105° F.; labored breathing. Next day the steer appeared about the same, and died on the morning of November 26th. A postmortem examination showed the lungs highly congested, and large numbers of living worms were seen crawling around in the bronchial tubes.

The steer that was given the ten minutes in the sulphuric gas also died on the morning of the 26th; lungs were collapsed, blackened in color; bronchi were very much congested; blood-red staining under the mucous membrane. This red staining extended into the right auricle and ventricle of the heart, but was absent in the left. No living worms were found in the lungs, but a few dead ones were observed. Up to December 29, I have held postmortems on 40 head, and found worms in lungs of all but one; also in the stomachs of all. Since I first found these worms I have given the animals calomel, areca nut, tartar emetic, and santonine, as well as several other remedies, but have not yet had time to decide what benefits, if any, have been received from the administration of these drugs.

From this account it is clear that Drs. Folsetter and Knight also found *Strongylus Ostertagi* in the stomach. They further found *Strongylus contortus*, as is evidenced by specimens which they forwarded to the laboratory of this Bureau for determination.

My own experiments in attempting to kill the lungworms agree essentially with the account given by Dr. Folsetter. Various kinds of fluids were used, but none was found which was in any way reliable.

In one lot of 18 steers, I believed that some temporary benefit resulted, but from later experience I was convinced that these injections not only could not be relied upon to kill the worms, but in most cases did more harm than good. The 18 steers mentioned improved, probably, in spite of the injections rather than because of them.

In all, about 30 animals, which had received from one to two tracheal injections were examined postmortem, and in only a single case were the worms dead. In this case, however, the injection undoubtedly hastened the death of the steer.

From the experiences of Drs. Folsetter and Knight at Houston, and from my own experiences in Dewitt, Gonzales, and Victoria counties, I can not escape the conclusion that the value of tracheal injections has been greatly overestimated. The alleged recoveries due to this treatment, reported by other authors, are, perhaps, misinterpretations of results. Failing in the tracheal injections, I tried other methods of treatment.

Gasoline.—Gasoline was administered in drenches, from one to nine in number, at intervals of one to three days. This treatment expelled many worms from the intestinal tract, and as the gasoline is excreted rapidly through the lungs, I had hoped that it would result in expelling the lungworms. The treatment was, however, a failure, for several animals were killed and examined a week or so after the last dose was given, and, with the exception of a single case, the lungworms were unaffected.

Turpentine, oil of cloves, and other substances highly recommended, gave the same negative results as gasoline.

Chloroform.—In one instance a steer was kept under the influence of chloroform for three-quarters of an hour. The next day it was killed, but the worms were alive and active.

Summarizing the subject, I know of no treatment which can be relied upon to kill the lungworms of cattle and sheep; and I believe their effects upon the health of the animals have been greatly exaggerated, except, of course, in very severe infections.

TREATMENT OF INTESTINAL WORMS.

It has been stated above that my experiments in treating lungworms were negative, and that I see no immediate outlook at present for successful medical treatment of infections with nodular disease of the bowels and with *Strongylus Ostertagi* in the wall of the fourth stomach. For infections with the twisted wireworms (*Strongylus contortus*) in the fourth stomach, the hookworms (*Uncinaria*) and adult nodular worms (*Œsophagostoma*) of the bowels, the outlook is more encouraging.

Numerous methods of treatment have been suggested for round worms in sheep and cattle, and every method has its adherents and admirers. While several different remedies are reported as successful, or as resulting in improvement, it can hardly be stated that an ideal method of treatment has as yet been discovered.

The great desideratum is some drug which can be given in a single dose, preferably in tablet form. It is all very well for a man to suggest a remedy to be given in a drench two or three times per week for several weeks, if there are but two or three sick animals to be treated and these are kept around the house. When steers run in a thousand-acre pasture and have to be "roped" on horseback, as in Texas, or when sheep are kept in large flocks in pastures several miles or 10 to 40 miles in extent, as in some of our Western States, an entirely different proposition presents itself.

Bluestone.—In South Africa, bluestone has been highly recommended for stomach and bowel worms. I have tried this remedy and have, undoubtedly, had some success with it, but upon killing animals which were treated, I have still found quite a number of living worms present. Bluestone does not, therefore, appear to be a perfect remedy. While it is reported as being efficacious against tapeworms, my own experiments do not fully confirm this report.

Gasoline.—Gasoline has recently gained considerable reputation as a vermifuge. I have used it in a number of cases and have found the claims made for it to be more or less justified. Three objections, however, arise to its use, and I can not, therefore, consider it an ideal treatment. These objections are:

(1) Not less than three doses, and usually four to six, are required to expel the worms. Its use involves a great expenditure of labor, and it is therefore impracticable on the large ranches.

(2) While several doses are not necessarily injurious to the stock, still, if the doses are large, repeated drenches cause a more or less severe congestion of the bowels. Not only that, but repeated handling of range sheep, with the necessary preliminary treatment of withholding food, is injurious to the animals.

(3) If used on animals suffering from pleurisy, it is likely to be fatal. I have had several fatal cases of this kind.

Nearly all vermifuges are, however, more or less poisonous in one way or another, and gasoline, if properly used, is not particularly dangerous. The necessity of repeating the dose from four to nine times in order to effect a complete cure will, however, militate against its general adoption.

If gasoline is used, ammonia also should always be kept on hand. If an animal is suddenly overcome by the effects of gasoline, a small amount (a teaspoonful or so) of aromatic spirits of ammonia may be given in water as a drench, to be repeated if necessary, and will usually result in the recovery of the patient.

The usual doses of gasoline for stomach worms are:

Lambs	¼ ounce.
Sheep	½ ounce.
Calves	½ ounce.
Yearling steers	1 ounce.

I have used these doses repeatedly without any serious effects. Each dose is mixed separately in linseed oil, sweet milk, flaxseed tea, or an egg, and given as a drench. If given directly in water, it is more severe on the patients.

An ounce and a half of gasoline has resulted in the immediate death of a full-grown ewe, but in some cases I have given to full-grown sheep as high as 2 to 3 ounces without serious results. I have also given as much as 3 ounces to a yearling steer, and 7 ounces (within an hour) to a horse without serious symptoms. I have also given 3 ounces to a full-grown chicken, which became very stupid for a time, but eventually recovered. On the other hand, in one case, a yearling steer, in apparently quite healthy condition, succumbed within two minutes after a dose of 1½ ounces. These large doses were given experimentally to determine the danger point, and they should never be used by farmers in treating stock.

In one instance a steer was suddenly overcome because the operator who was administering the dose for me accidentally held the head too high and the medicine entered the lungs. The animal fell immediately and appeared to be almost dead. I happened to have a hypodermic syringe with me and some tablets of sulphate of strychnine. A hypodermic injection of this substance was immediately given and within five minutes the animal was feeding as if nothing had happened. This incident led me to overdose several animals with gasoline and then to try to revive them with hypodermic injections of strychnine. In all cases the treatment was successful. It is thus seen that injury from gasoline may be counteracted by either aromatic spirits of ammonia or by strychnine.

Besides these vermifugal substances various other remedies were tried. Two remedies in particular give promise of solving the problem of a single dose. My experiments with these are not yet fully completed, but they are advanced to a point which, I believe, justifies me in making a preliminary report upon them. It is, however, distinctly stated that these remedies, as used for the wireworm of the fourth stomach and for roundworms in the bowels of sheep, are still in their experimental stage. If any farmer is inclined to try them he is advised to first use them on two or three animals of his flock and watch the results for a week before dosing his entire flock. These substances are coal-tar creosote and thymol.

Mr. Sterne, of Victoria, Tex., kindly placed at my disposal a flock of sheep which were suffering severely from both *Strongylus contortus* and *Uncinaria cernua*. The animals were divided into five lots, and different mixtures were tried. The same remedies were also tried on calves, yearlings, and two-year-olds in the same vicinity. The results were as follows:

EXPERIMENTS WITH COAL-TAR CREOSOTE.

A 1 per cent solution of coal-tar creosote was made as follows:

Coal-tar creosote	1 ounce.
Water	[1] 99 ounces.

Twisted wireworms (*Strongylus contortus*) taken directly from the stomach of sheep or cattle died in one-half to one and a half minutes when immersed in this solution.

If, in dosing, this liquid enters the lungs, the animal succumbs in a few minutes. If the dosing is performed carefully, as much as 6⅜ ounces may be given to a full-grown sheep without fatal results. In some cases, however, the animal shows ill effects, from which it usually recovers within half an hour. Six ounces were given to a number of sheep without the slightest ill effects. The following table gives the doses of the 1 per cent mixture, which were used in about 150 cases without ill effects:

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[1] 99 ounces=6 pints and 3 ounces.

Lambs 4 to 12 months old	2 to 4 ounces (about 60 to 120 c. c.).
Yearling sheep and above	3 to 5 ounces (about 90 to 150 c. c.).
Calves 3 to 8 months	5 to 10 ounces (about 150 to 300 c. c.).
Yearling steers	1 pint (about 480 c. c.).
Two-year-olds and above	1 quart (about 960 c. c.).

The sheep showed a marked improvement a few days after receiving a single dose. Calves also showed a marked improvement, and in a few cases some of the older animals were also much better. In some cases no improvement whatever was noticed.

I had already made experiments with creosote at Washington, D. C. Sheep were drenched with a 1 per cent solution and killed immediately afterwards. Upon opening the fourth stomach, it was found that the wireworms present were dead. In some cases where this was tried later the wireworms were found to be still alive, but I believe that the explanation of this fact has now been discovered. (See below, p. 375.) As yet it is not definitely established how much effect creosote has upon the worms below the stomach. (See also footnote, p. 373.)

EXPERIMENTS WITH THYMOL.

Immediately upon finding hookworms (*Uncinaria*) in the sheep in Victoria, I determined to use thymol, since this is supposed to be the most effective remedy against worms of this genus. The doses usually prescribed in veterinary works appeared to me too small to be effective in an animal with such a large stomach, and with the chances of losing part of the medicine in the first stomach. In some preliminary experiments the doses were cautiously increased up to 48 grains per sheep, without causing any recognizable symptoms. Then doses were given as high as 80 and 100 grains to a full-grown sheep and 240 grains to an old cow, without visible serious results. Having thus established the fact that larger doses than are usually recommended could be given, a solution of thymol in alcohol was made and administered to sheep, so that each animal received from 32 to 48 grains of thymol.

A day after dosing, two animals were opened, but the parasites were present in large numbers. About a week later one animal, which was very far gone at the time of dosing and which we had not expected to live, was dissected and only a very few hook worms were found. This sheep had also received a dose of creosote in the stomach; no adult wireworms were found, but numerous very young specimens were present, pointing to a recent infection.

As other cases treated with creosote had not resulted in expelling the hookworms, it seemed a justifiable presumption that it was the thymol that had proved effective in this case. Neither thymol nor creosote had, however, expelled the fringed tapeworms.

As Mr. Sterne had lost about 50 per cent of his entire flock up to the time of treatment, and as after dosing the animals showed such a very decided improvement, I did not feel justified in killing any more of them for postmortem work. I turned to a microscopic examination of the feces to confirm the results of the treatment.

For the benefit of those not familiar with this class of work, it may be stated that if a microscopic examination is made of the fecal matter of animals affected with intestinal parasites, particularly with twisted wireworms, lumbricoid worms, or hookworms, eggs of the parasites can be discovered. In fact, in certain diseases in man, as in hookworm infection, this is the regular method of making a correct diagnosis.

Before dosing this flock, a number of microscopic examinations were made, and eggs were found within five to fifteen seconds. After dosing with creosote and thymol it took from twenty to sixty minutes to find a single egg. This fact indicated that after a week's time a single dose of 32 to 48 grains of thymol had resulted in practically ridding the sheep of hookworms (*Uncinaria*) in the bowels. It was also clear that it took this substance several days to act in the sheep.

Thus, this first series of experiments with thymol *appears at present* to be exceedingly encouraging. I will not state that the problem of finding a remedy which will be effectual, *in a single dose*, in expelling both twisted worms and hookworms has been fully solved, but the indications are that these experiments are in the right direction. These experiments will be repeated very shortly and the results will be made known. In the meantime, if any other investigator or any farmer desires to try the treatment on his own responsibility, he can use the experiments here reported as a basis in planning his work.

Unfortunately it frequently happens that the results of preliminary experiments, even when exceedingly promising, as in the present case, are not confirmed by later investigations. From the present outlook, however, the indications are that either thymol alone or combined with a 1 per cent solution of creosote will be superior to any other medicinal treatment for roundworms in sheep or calves as yet adopted.[1]

Other experiments with thymol also indicate that this drug will be of great value in expelling roundworms from horses and hogs. Thus, Theobold has recently reported that the administration of two doses of 15 grains each (one dose each day for two days), followed by a strong dose of castor oil, has given excellent results in expelling roundworms from horses. He says (Theobold, 1900, pp. 65, 66):

> *Oxyuris* and red strongyles may readily be cleared from the intestines and even killed in the mucous membrane, where they encyst, by the use of thymol. Thymol

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[1] In experiments upon sheep conducted at Victoria in July, 1901, the best results were obtained by combining the creosote and thymol treatments. Thymol tablets proved unsatisfactory, but powdered thymol was given, being washed down by the creosote solution. From five to seven days after a single dose, the eggs of the parasites practically disappeared from the feces.

is best administered in sweet milk, and should be given in 15-grain doses. Two doses should be given, one in the morning and another the next morning; the last dose being followed in a few hours by a strong dose of castor oil. Thymol can be dissolved in alcohol. In some cases the effect of this drug has been to cause a slight bleeding at the nose, but not to any serious extent. When an animal is very emaciated from these nematode parasites the drug may produce a slight partial collapse; in such cases a stimulant should be given, when the patient is found to speedily recover. For red strongyles (*Sclerostoma*) thymol only is of any use, but for such pests as the oxyures, or even Ascaridæ, santonine may be employed; but even for these worms it is extremely uncertain in action, while thymol is always effective. The dose of santonine recommended by Neumann is from 100 to 150 grams, but this must surely be excessive. Small doses, however, I know, are quite useless for the large horse *Ascaris;* in fact, it may be taken as a rule in regard to vermicides that one strong dose is much more effective than repeated small ones. As much as 3 drams of thymol have been given to horses without any serious results. This drug has been used, I have been informed, by Dr. Giles, H. I. M. S., many years ago in India for the red strongyles.

Elsewhere Theobold (1898, p. 24) writes:

All sclerostome diseases have long baffled curative treatment, but thanks to the suggestion of Dr. Blanc, of Cannes, a remedy is now known for the intestinal and mucous attacks of these pests, which has in all cases proved successful. This nematocide is *thymol.* Thymol, although used for the first time in England as a horse nematocide, has been employed previously as a human drug. Thymol was at first used, in a case of a severe epizootic of sclerostomes that I investigated at Charlbury, by Miss Dillon in her stud of Arabs. The dose administered was 15 grains in the morning and again at night, followed by a mild purgative. Ten grains is sufficient for a foal. Sir George Brown informs me that he has used as much as 3 drams without any evil results. Another correspondent gave 60 grains without any serious symptoms. In one of Captain Cullen's fillies bleeding at the nose followed the dose of thymol, but not in any serious form. From previous experience, 15 grains may be taken as sufficient to stem the advances of the disease, but in foals 10 grains is ample. Experiments have shown that these doses kill not only the free worms in the intestinal contents, but also those in the cysts. Practically all nematodes are affected by this substance, *Ascaris megalocephala* being readily expelled by it. It may therefore be generally substituted for santonine, which is extremely erratic in behavior.

In experiments conducted in dogs, cestode or tapeworms were not moved by thymol; it is apparently valueless as a tænicide. The dose for roundworms in dogs should not exceed 2 grains. Three grains produced partial prostration in a bull terrier. In fowls 1-grain doses have caused the rapid expulsion of *Heterakis* worms. Cats can also take 2-grain doses without being affected.

Thymol is best dissolved in spirit; 15 grains easily dissolve in an ounce of spirit, and should be administered in milk.

Should worms still be passed, a second dose two days following is sufficient to complete the cure. As the worms in the walls of the intestine are destroyed, repeated doses are not necessary.

Theobold (1897, p. 8):

* * * With regard to cleansing the paddocks used by the diseased animals, salt and lime have been advised and used as a dry dressing broadcasted over the grass. Experiments have shown that this has no effect whatever unless used at such a strength that the grass would be destroyed. Horses should be kept off the land for some time—not less than a year—the same applying to asses and mules, which also would probably become affected. * * *

Thymol.—The dose found most beneficial is 15 grains early in the morning, and the same quantity at night, followed next day by a dose of castor oil. This remedy was suggested by Dr. Blanc, of Cannes, and has proved to be one of the greatest value. The dose may seem excessive, but horses can stand very strong doses, and it is a well-established fact, both in human as well as veterinary medicine, that small doses, even if repeatedly given, are of no use in vermiceous diseases. If signs of collapse are shown after the dose, stimulants should be given to the patients, who speedily rally. The results of the employment of thymol and proper sanitary measures are that all the patients have recovered and the disease stamped out.

One objection to the present method of treatment is the administration in an alcoholic solution. On this account I have requested the manufacturers to prepare for me tablets of thymol containing each 10 or 20 grains. Preliminary experiments, just completed at Washington, show that so far as administration is concerned, the tablet form is a great improvement. Two or more tablets are placed in the sheep's mouth and washed down with a drench of water. It still remains to be proved whether the tablet form is equally effective.[1]

Thymol, like many other vermicides, is poisonous if given in too great quantities, and several cases of death in man have been reported from its use.

METHODS OF DRENCHING ANIMALS.

The popular method of drenching is with a bottle. The use of a *drenching tube* is, however, far more satisfactory. A drenching tube may be made by taking an ordinary tin funnel, which may be purchased for five or ten cents, and inserting the narrow end into one end of a rubber tube or hose, say three feet long and three-eighths or one-half inch in diameter; into the other end of the rubber tube is inserted a piece of three-eighths-inch brass or iron tubing about 4 to 6 inches long. The metal tube is then placed between the animal's back teeth, and the sheep or calf is allowed to bite upon it. The water or drench is poured into the funnel, which may be held by an assistant or fastened to a post at a convenient height. The man who holds the metal tube between the animal's teeth can then control the animal's head with the left hand, and by holding the tube in the right hand, near the point of union of the rubber and metal tubes, he can easily control the flow of the fluid by pinching the rubber hose. Care must be taken not to hold the patient's nostrils closed, otherwise the dose will enter the lungs.

POSITION OF THE ANIMAL DURING DRENCHING.

Different persons prefer to hold the animals in different positions during drenching. Thus (1) the animal may be left standing on all four feet; or (2) it may be placed on its haunches, one man holding its back up against his own body; or (3) it may be placed directly on its back on a sloping piece of ground, its head being in a direct line with its back, and higher than its rump; or (4) it may be placed upon its side, the head being brought around so that the horns are squarely on the ground; the operator may then place one foot on one of the horns (especially in the case of semiwild cattle) and thus aid in holding the animal still.

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[1] As stated in the footnote, page 373, the tablets were not satisfactory.

So far as administering the doses is concerned, the position on the back (3) is by far the easiest in the case of sheep, and the side position with head down (4) is the easiest in dosing cattle; furthermore, in these positions there is much less danger of an accident by getting the dose in the lungs. If animals are dosed standing or on their haunches, the nose should never be allowed to go above the eyes; otherwise the drench may pass down the windpipe into the lungs.

By dosing sheep with water colored red and blue with dyeing material, and killing the animals immediately after the liquid was swallowed, the following results were obtained:

If the dose was given with the sheep standing (1), almost the entire quantity went directly into the fourth stomach; if the sheep was placed on its haunches, the fluid passed in part into the fourth stomach and in part into the first (the paunch); if the sheep was placed directly on its back (3), or if a steer was placed on its side (4) with head down, almost the entire dose passed into the first stomach (the paunch); if the animal, even when standing (1) struggled to a considerable degree, a portion of the fluid passed into the paunch.

It will be immediately apparent that these facts are of practical importance in dosing. If, for instance, gasoline, turpentine, or creosote is used, better results may be expected if the sheep is dosed standing (1). If thymol is used it seems probable, at present, that the position on the back (3) or side (4) will be equally good for the purposes of this drug, although this point at the present moment needs to be further confirmed before it is accepted.

LIFE HISTORIES OF THE PARASITES MENTIONED.

In order to adopt measures looking to the prevention of the parasites here discussed, it is necessary to understand their life histories. The life cycle has not been demonstrated as yet in all cases, but from the structure of the worms and from what is known of the life histories of closely allied parasites, enough can be foreseen, with a degree of probability which borders upon certainty, to enable us to adopt practical measures of prevention.

In the case of the stomachworms (*Strongylus contortus* and *Str. Ostertagi*) and the hookworms (*Uncinaria radiata* and *U. cernua*) of the bowels, the female worms lay numerous eggs; these escape with the droppings of the animals; each egg develops into a microscopic creature known as a rhabditiform embryo; this embryo lives for a while in the moist earth or in puddles and pools, and, casting its skin *several times*, undergoes certain changes in structure; later it is swallowed by the sheep or cattle either while grazing on infected pastures or drinking infected water; the young worm then passes to its normal position in the stomach or bowels and develops into an adult.

In the case of the lung worms the egg contains an embryo when laid. This egg is either expelled from the mouth or nostrils or is swallowed and passes out with the droppings. What happens next is not absolutely demonstrated, but the indications are that the young worms are swallowed by earthworms, in the body of which they undergo certain changes. How they then gain access to the cattle and sheep is not yet established.

In the case of tapeworms the eggs pass out with the droppings and are probably swallowed by some invertebrate animal, such as an insect or worm. In the bodies of these animals the young tapeworm may be expected to undergo certain changes in structure, and eventually to be swallowed by the sheep.

PREVENTIVE MEASURES.

While the outlook for successful medical treatment of cases of lungworm infection and of infection with the encysted stomachworm (*Strongylus Ostertagi*) is not encouraging, and while some points in connection with the treatment of twisted worms and hookworms remain to be developed further, the above account of the life histories of the parasites shows that at least a great part of the infection may be prevented. The methods which I would suggest are:

First. Every ranch should have a hospital pasture situated on high, dry ground, well drained, and without any pools or ponds; it should be supplied with raised troughs for watering and feeding, and the water supply should come from a well. This pasture should not drain into any pasture in which healthy stock are feeding.

Second. As soon as any sick animal is noticed in the large pasture it should immediately be separated from the healthy stock and taken to the hospital pasture. To allow sick animals to run at large with healthy stock means to deliberately permit the spread of infection in the pastures and thus endanger the well animals.

Third. Proper watering places should be supplied in the large pastures by digging wells and erecting windmills to pump the water into tanks. These tanks should be raised above the ground so that they can not become contaminated with the droppings from animals being washed into them by rains and floods.

Fourth. Select high sloping ground for pasture when this is possible. Low pastures should be properly drained.

Fifth. Burn the pastures regularly, thoroughly, and systematically. The heat from the burning grass will kill many of the eggs and young worms on the grass, ground, and in the droppings.

Sixth. As these parasites are more fatal to young animals than to old ones, a liberal supply of oats or some similar food will aid in giving to young animals strength which will enable them to withstand the infection. A daily allowance of, say, half a pound of oats per lamb ought to reduce the mortality. At first they may not be inclined to eat it, but will soon become accustomed to it. This simple precaution is reported as very effectual in New Zealand.

Seventh. Keep plenty of salt accessible to the animals. Some men add slaked lime to the salt. As a matter of experience, salt kills many young worms.

THE OUTLOOK.

Unless proper precautions are adopted the trouble which southern Texas has experienced during the past two years may be expected to recur during wet years in the future. During dry years the losses will be much less severe.[1]

INFECTIOUS BUT NOT CONTAGIOUS.

A number of ranchmen have inquired whether this disease is "contagious." It is not contagious; that is, one animal will not contract it directly from another. It is, however, infectious, and one sick animal may infect a pasture so that the disease will spread to the healthy stock. Care should therefore be exercised in purchasing new stock, especially calves and yearlings, that they come from healthy, dry pastures.

THE DISEASE IS NOT TRANSMISSIBLE TO MAN.

Fear has been expressed by some persons that this disease may spread to man. Such fears are without foundation. None of the parasites here mentioned for cattle, sheep, and goats have ever been known to occur in the human body, and so far as danger of infection is concerned I would not have the slightest hesitation in swallowing the germs in question. Parasites are known for man which are similar to those mentioned in this paper, but they belong to entirely different species.

MILK AND MEAT FROM THE SICK ANIMALS.

Milk and meat from sick animals is not so good as that from healthy animals. There is no danger from drinking the milk or eating the meat from animals suffering from the parasites here discussed, especially if the animals are in the early stages of the disease. All sheep and cattle are more or less infected with worms, and, as a rule, it is only the cases of heavy infection which are noticed. It is self-understood that the meat and milk from animals in the last stages of these diseases are not of normal character, hence should not be used.

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[1] Owing to the dry spring and to the extensive burning of pastures during the winter, the outbreak of disease described in this paper has been almost entirely checked. In a recent visit to Victoria County, I heard practically no complaint regarding worms in cattle. The sheep on one ranch showed infection, but much less severe than during the winter.

GEOGRAPHICAL DISTRIBUTION OF THE OUTBREAK.

My own investigations showed this outbreak of verminous disease to be present in Texas in Dewitt, Goliad, Gonzales, Victoria, and Jackson counties. Doctors Knight and Folsetter have also diagnosed it for Navarro, Kimball, McMullin, and Harris counties in Texas, and in Indian Territory. It is probably more or less general in other counties in Texas and in other Southern States.

THE LOSSES.

Owing to the fact that some ranchmen suppress information in regard to stock losses it is impossible to give an exact estimate of the number of deaths in Texas this past year from parasitic worms. Doctors Knight and Folsetter and myself, together with several prominent stockmen, consider that 10,000 head is a conservative estimate for the losses among the cattle. In some herds 20 to 40 per cent of the animals died.

Two flocks of sheep are known to me whose owners estimated their losses at about 50 per cent.

ACKNOWLEDGMENTS.

In conclusion, I desire to acknowledge my obligations to several persons who have extended courtesies and hospitality to me during the investigations. In particular, acknowledgments are due to Dr. Folsetter, of Dallas, veterinarian of the State sanitary board, and to his colleague, Dr. Knight, of Houston. Our early investigations were made independent of each other and neither knowing of the other's results. Later we examined several herds together. To Dr. Hugh Crouse, of Victoria, and to Dr. Shimer, of Meyersville, I am also indebted for many professional courtesies. The stockmen who aided me in material or information are too numerous to mention all by name, but I desire to express my obligations especially to Judge Fly and Messrs. Sterne, Bindewall, Welder, and Griffith, of Victoria; to Messrs. Duderstadt, Schaeffer, and Buehrig, of Meyersville, and to Messrs. Houston, Jones, and Pfender, of Gonzales.

THE CATTLE TICKS (IXODOIDEA) OF THE UNITED STATES.

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AND

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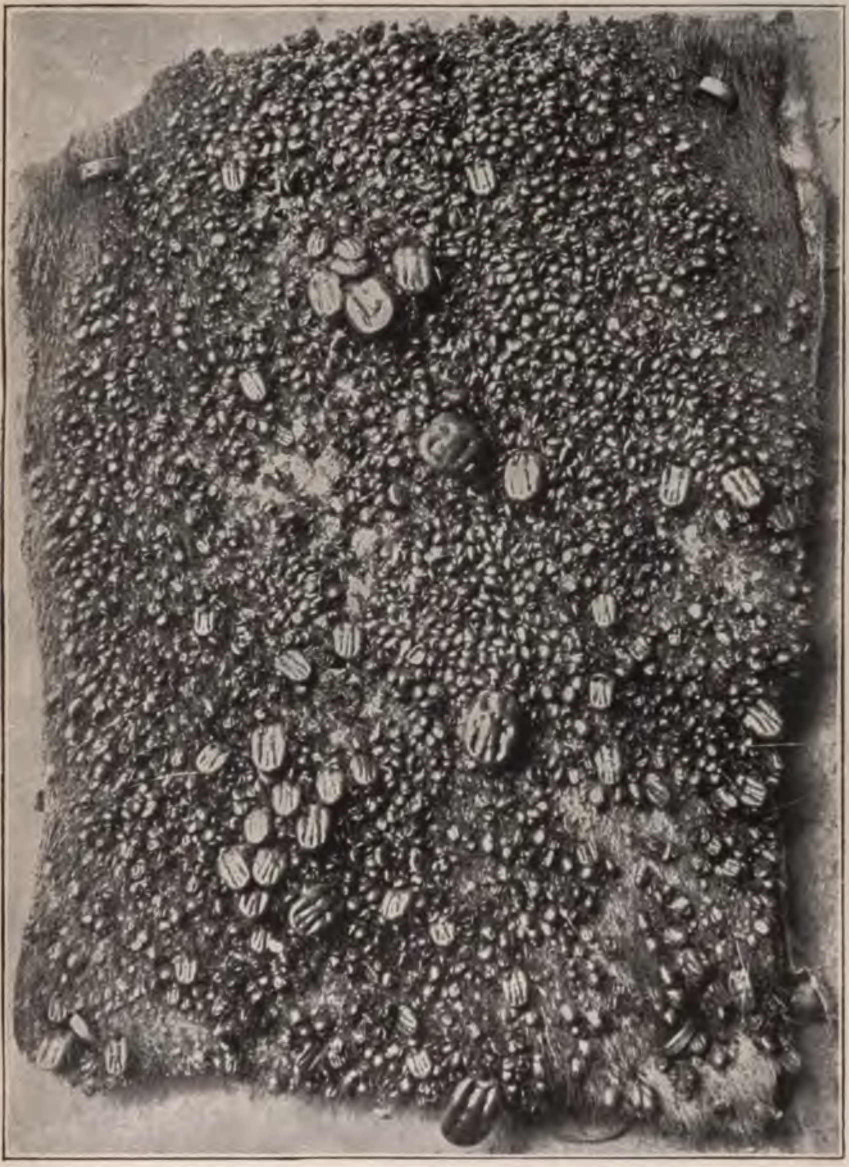
INTRODUCTION.

Objects of the present paper.—The present paper is intended primarily as a guide to the inspectors of the Bureau of Animal Industry in their quarantine work against Texas fever. On this account only such forms will be described and figured in detail as inspectors are more likely to find on cattle. Brief reference will be made, however, to other genera and species, since it can not be foreseen what forms may be accidentally found. We are especially likely to meet with some of the numerous Mexican and Central American species which may be accidentally spread, particularly to the Southern States, by migratory birds, by imported animals, by produce, or by travelers. Once introduced in this way it is in many cases a matter of chance whether they will attack cattle. Our closer relations with Porto Rico, Cuba, and the Philippines also present increased opportunities for the introduction of exotic ticks into the United States.

The importance of being able to recognize the Texas fever tick (fig. 42) (*Boophilus annulatus*, more commonly known as ***Boophilus bovis***) and to eliminate other forms is immediately apparent when it is recalled that the Texas fever quarantine line, extending from the Atlantic to the Pacific, is based upon the presence or absence of this species.

Arrangement of paper.—The present paper is so arranged that an inspector may inform himself in a very short time in regard to the common ticks of cattle. For this purpose he should study the text which is printed in the larger type and the illustrations. The descriptions and keys, printed in the smaller type, are intended for use in connection with specimens.

Ticks which are sent in for determination should be addressed to the



PORTION OF A STEER'S HIDE, SHOWING THE TEXAS FEVER TICK (BOOPHILUS ANNULATUS) OF THE UNITED STATES. NATURAL SIZE. ORIGINAL.

"Bureau of Animal Industry, for Zoological Laboratory." It is always better to forward *live* specimens when possible, and to send several of each sex if they can be obtained. For transmission they may be placed, without packing, in a pill box or other convenient receptacle.

Method of examination.—In many cases a tick taken from cattle may be quite positively determined without the aid of a microscope. In view of the importance of avoiding an incorrect determination it is, however, advisable to examine the specimens with a hand lens. No preserving fluid or technique is necessary. The specimen is simply held between the thumb and first finger of the left hand, so that it may easily be turned, and the magnifying glass held in the right hand and brought into focus.

If finer microscopic work is desired, the specimen may be killed in boiling water or alcohol. The next step depends upon the nature of the study proposed. If ordinary glycerin preparations of the hard parts are desired the specimen is dissected, the soft parts being cut away as much as possible. The structure intended for mounting may then be placed in a 2 to 10 per cent solution of caustic potash until the remaining soft tissues are destroyed. Next, transfer the specimen to water, in which it is left (the water being changed once or twice) until the caustic is washed out. Finally, the object is placed on a slide, a drop of glycerin added, and the specimen protected with a cover slip; or, if a balsam mount is desired, the specimen is washed as above, after being treated with caustic and then, after being dehydrated by placing it successively in alcohol of 50, 70, 95, and 100 per cent, transferred to xylene or like fluid and mounted in balsam. Very satisfactory mounts of an entire male, nymph, or larva may be made by the above methods.

Section cutting of ticks is difficult and tedious, owing to the thick tegument. A method used by zoologists gives very good sections when one has the patience to carry it out. The entire body is prepared in the usual way—killed in hot water, sublimate solution, or alcohol—then passed through alcohol (70, 90, and 100 per cent) and xylene, and embedded in paraffin. Before each section is made with the microtome, the exposed surface of the embedded object is covered with a thin film of a colorless solution made from mastixcollodion, absolute alcohol, and ether. The sections are fastened to the slide by a thin film of a solution of equal parts of glycerin and albumen, then treated in the usual way—dissolve paraffin, stain sections, dehydrate, and mount.

Classification, synonymy, and literature.—Quite recently Prof. L. G. Neumann has completed a monographic revision of the ticks of the world. For this work he has had not only almost the entire collection of Ixodoidea belonging to this Bureau, but also specimens from numerous other laboratories and collections.

As the ticks belonging to the Bureau are still in his possession, we have been obliged to depend very largely upon Neumann's papers for the analytical keys to the species of the different genera. Some of the characters selected by him appear to us, however, rather difficult to use. We have accepted Neumann's synonymy[1] in almost every instance except in *Boophilus*, since he has had at his disposal not only a large number of specimens, but many types as well. Neumann's classification is here followed, except for some slight changes. It seems to us, for instance, that the differences between the two chief groups of ticks are sufficiently great to admit of two families, rather than two subfamilies. We also recognize the genus *Boophilus*, and in this we distinguish, with Fuller, at least three species, namely, *B. annulatus*, *B. australis*, and *B. decoloratus*.

In selecting the technical names the International Code of Nomenclature has been followed. It must, however, be remarked that a comparison of original type specimens may eventually result in slight changes in the nomenclature adopted. Most of our technical names agree with those adopted by Neumann, but we have considered it necessary to use *Ixodes ricinus* instead of *I. reduvius*, and to differ from Neumann in regard to Linnæus's *Acarus americanus*. (See p. 488.)

In connection with the synonymy brief bibliographic citations have been given, but no effort has been made to publish a complete bibliography of the species discussed. The Harvard short method of citation has been followed; full references may be obtained by consulting the bibliography (pp. 478–488).

THE POSITION OF THE TICKS IN SYSTEMATIC ZOOLOGY.

Ticks are placed by zoologists in the Arthropoda, a very extensive group, or phylum, which includes all animals possessing an external chitinous skeleton, a ventral nervous system, dorsal digestive system, together with jointed extremities. The group Arthropoda is divided into a number of classes, the more important of which are—

Hexapoda, or Insecta (insects), provided with three pairs of legs.

Myriapoda (thousand legs), provided with numerous pairs of legs.

Arachnoidea (spiders, ticks, mites, etc.), provided with four pairs of legs.

Crustacea (crabs, lobsters, etc., in most cases aquatic arthropods), usually with a pair of extremities to each segment.

Ticks belong to the class Arachnoidea, order Acarina, and are thus closely related to the mites which produce scab, mange, and itcl Acarines may be divided into the following families:

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[1] Many of the descriptions of ticks given by early authors are so incomplete that a positive synonymy of all of the forms is out of the question. In many cases it is impossible clearly to recognize the species with which an author is dealing, even when he uses for it the name of a very commonly known form. On this account it is frequently necessary to accept in synonymy a bibliographic reference to a given name simply because it is impossible to prove definitely that the reference under consideration does not deal with some other species than the one indicated by its name.

A.—Body elongated.—*Vermiformia.*

No tracheæ. Legs with epimeres.	Two pairs of legs. Palpi unarmed. Mandibles styliform.	Phytoptidæ.
	Four pairs of legs. Palpi uncinate. Mandibles styliform.	Demodicidæ.

B.—Body compressed.—*Acarina.*

No tracheæ. *Astigmata.* Legs with epimeres.	Palpi joined at base, unarmed. Mandibles chelate.	Sarcoptidæ.
Tracheæ opening in the anterior portion of the body, atrophied in the aquatic forms. *Prostigmata.* Legs with epimeres.	Palpi free, unarmed; antenniform. Mandibles chelate.	Bdellidæ.
	Palpi free, armed. Mandibles with hooks, or styliform.	Marine: **Halacaridæ.** Fresh water: **Hydrachnid** Terrestrial: **Trombidiidæ**
Tracheæ opening in the posterior portion of the body, at the base of the legs, sometimes atrophied. *Metastigmata.* Legs without epimeres.	Palpi free, fusiform, mandibles chelate.	Oribatidæ.
	Palpi free, filiform or valvate. Mandibles, pseudo-chelate.	Argasidæ: Ixodidæ.
	Palpi free, filiform. Mandibles chelate.	Gamasidæ.

Superfamily Ixodoidea[1] Banks, 1894.

From the table of synonymy given in the footnote, it will be se that there has been considerable difference of opinion relative to tl systematic rank to be given to this group, the latter having been reco nized by various authors as representing a distinct family, superfamily, suborder, and order. To our minds Banks's proposition of a superfamily seems the best, hence it is adopted here.

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[1] Synonymy and Bibliography.

1804: Fam. *Riciniæ* (in part) Latreille, 1804, pp. 46–53.—Idem, 1829, pp. 286–289. Risso, 1826, pp. 180–184 (pars).—Oudemans, 1896, pp. 191–197. [See al Trouessart, 1891, p. 290.]

1815: Fam. *Ixodides* Leach, 1815, pp. 396–399.—Fuller, 1896, p. 763.

1837: Fam. *Ixodea* Burmeister, 1837, p. 579.—Grube, 1859, p. 455.—Gerstaeck 1860, p. 464.

1847: Order *Ricini* Koch, 1847, pp. 5–136.—Fürstenberg, 1861, p. 208.—Canestri 1890, p. 482. [See also Trouessart, 1892, p. 298.—Marx, 1892, p. 232.]

1855: Fam. *Ixodida* Küchenmeister, 1855, pp. 421–424.—Kolenati, 1857, pp. 19–

1863: Fam. *Ixodidæ* Gerstaecker, 1863, pp. 343, 344.—Conil, 1877, pp. 28, 29.—Cla 1880, p. 652.—Michael, 1884, p. 50.—Berlese, 1855, p. 131.—Ludwig, 18 p. 612.—Riley, 1887, pp. 744, 745.—Marx, 1892, p. 232.—Trouessart, 18 pp. 28, 33, 37, 38, 45, 46, 47.—Neumann, 1892b, pp. 94, 95–105.—Railliet, 18 pp. 631, 703–718.—Osborn, 1896, pp. 255–262.—Morgan, 1899, pp. 136, 141.

This superfamily may be divided into two families—Argasidæ and Ixodidæ.

The family Argasidæ (p. 400) is composed of two genera—*Argas* and *Ornithodoros*—while the family Ixodidæ (p. 414) may be further subdivided into the two subfamilies Rhipicephalinæ, with the four genera *Rhipicephalus*, *Boophilus*, *Hæmaphysalis*, and *Dermacentor*, and Ixodinæ, with the five genera *Ixodes*, *Eschatocephalus*, *Aponomma*, *Amblyomma*, and *Hyalomma*.

All of these groups may be readily distinguished by the following key:

KEY TO THE FAMILIES, SUBFAMILIES, AND GENERA OF THE SUPERFAMILY IXODOIDEA.

[For genera already reported on cattle in the United States, follow Roman type.]

1. Scutum absent.................................Argasidæ, 2.
Scutum present.................................Ixodidæ, 3.

FAMILY ARGASIDÆ.

2. Capitulum removed by at least its length from the anterior margin; body rounded anteriorly, without a projecting beak-like prominence; eyes absent..............*Argas*, p. 401.
Capitulum hidden under a projecting beak-like prominence (hood), so close to anterior margin that the tips of the palpi project from under the body and are visible from above; eyes present or absent...........*Ornithodoros*, p. 407.

FAMILY IXODIDÆ.

3. Palpi short, subtriangular, not or only slightly longer than broad; capitulum short; front of body emarginate for insertion of capitulum.......................*Rhipicephalinæ*, 4.
Palpi longer than broad; capitulum long; front of body straight or emarginate ....*Ixodinæ*, 7.

WARD, 1900a, pp. 193-205.—IDEM, 1900b, pp. 430, 435-437.—STILES & HASSALL, 1901, p. 1. [See also TROUESSART, 1891, pp. 291, 294, 301, 305, 308.]

1876: Fam. *Ixodidés* MÉGNIN, 1876, p. 293.—IDEM, 1877, p. 86.—IDEM, 1880, pp. 117-136.—RAILLIET, 1886, pp. 495-502.—IDEM, 1893, pp. 703-718.—NEUMANN, 1888, pp. 82, 87-96, 219-221.—IDEM, 1892a, pp. 90, 91, 92-101, 221-223.—IDEM, 1896, pp. 1-44.—IDEM, 1897, pp. 324-420.—IDEM, 1899, pp. 107-294.—BLANCHARD, 1890, pp. 322-339.

1876: Fam. *Ixodæ* WAGNER, 1876, p. 129.

1892: Order *Metastigmata* CANESTRINI, 1892, pp. 580-582, 587. Probably earlier. [See also TROUESSART, 1892, p. 28.]

1892: Suborder *Cynorhæstea* MARX, 1892, pp. 233-236.—MORGAN, 1899, p. 136.

1894: Superfam. *Ixodoidea* BANKS, 1894, p. 209.—SALMON & STILES, 1901, pp. 383-488.

SUBFAMILY RHIPICEPHALINÆ.

4. Dorsal surface of capitulum hexagonal, the sides being drawn out laterally into a sharp point; anal plates present on male; eyes present 5.

Dorsal surface of capitulum rectangular, sides straight; male without anal plates; eyes present or absent (*Anopli* Canestrini, 1890, p. 491) 6.

5. *Second and third palpal articles straight, not drawn out laterally into sharp points; stigmata comma-shaped* *Rhipicephalus*, p. 415.

Second and third palpal articles drawn out laterally into sharp points; stigmata nearly round *Boophilus*, p. 419.

6. *Coxæ I not bidentate; coxæ IV of normal size; eyes absent* *Hæmaphysalis*, p. 456.

Coxæ I bidentate in both sexes; coxæ IV much larger than I to III; eyes present *Dermacentor*, p. 447.

SUBFAMILY IXODINÆ.

7. Anal groove surrounds anus anteriorly and opens posteriorly; eyes absent 8.

Anal groove surrounds anus posteriorly and opens anteriorly 9.

8. Palpi valvate on median surface, in both sexes *Ixodes*, p. 459.

Palpi claviform, not valvate in male; legs very long *Eschatocephalus*, p. 468.

9. *Eyes absent; anal plates absent* *Aponomma*, p. 469.

Eyes present 10.

10. Anal plates absent *Amblyomma*, p. 470.

Anal plates present on males *Hyalomma*, p. 477.

TICKS OF THE UNITED STATES THUS FAR REPORTED FOR CATTLE.

Thus far the following eight species of ticks have been reported for cattle in this country, and it is these forms in particular which stock inspectors should hold in mind:

Argas miniatus, the Southern chicken tick, has been reported from cattle but once. (See p. 402.)

Ornithodoros Megnini, the ear tick, is more or less common, especially in the Southwest. (See p. 408.)

Boophilus annulatus, the North American Texas fever tick, is very common below the Texas fever line. (See p. 420.)

Dermacentor reticulatus, the net tick, is reported for California, Texas, New Mexico, and Indian Territory; it probably has a much more extensive distribution. (See p. 448.)

Dermacentor electus, the American dog tick, has a very wide range on this continent, being found both North and South. (See p. 455.)

Ixodes ricinus, the castor-bean tick, is common in many States of the Union. (See p. 462.)

Ixodes hexagonus, a European dog tick, is found particularly east of the Rocky Mountains. (See p. 467.)

Amblyomma americanum, the Lone Star tick, has a very wide distribution on the American continent, and is one of the most easily recognized species found on cattle. (See p. 474.)

Several other supposed distinct species have been mentioned by various American authors as infesting cattle in the United States, but it is probable that all of them are identical with one or another of the above-named forms. Thus, *Amblyomma unipunctatum* is identical with *A. americanum; Boophilus bovis* is identical with *B. annulatus; Dermacentor occidentalis* is identical with *D. reticulatus;* and *Ixodes scapularis* = (?). (We have not yet been able to recognize this last species.)

In the keys to the various ticks which are published in this paper, the cattle ticks of the United States have been compared with Ixodoidea found on other animals and also in other countries. The following artificial key to the above-mentioned eight species will be found somewhat easier to follow until the inspector becomes acquainted with the most common forms:

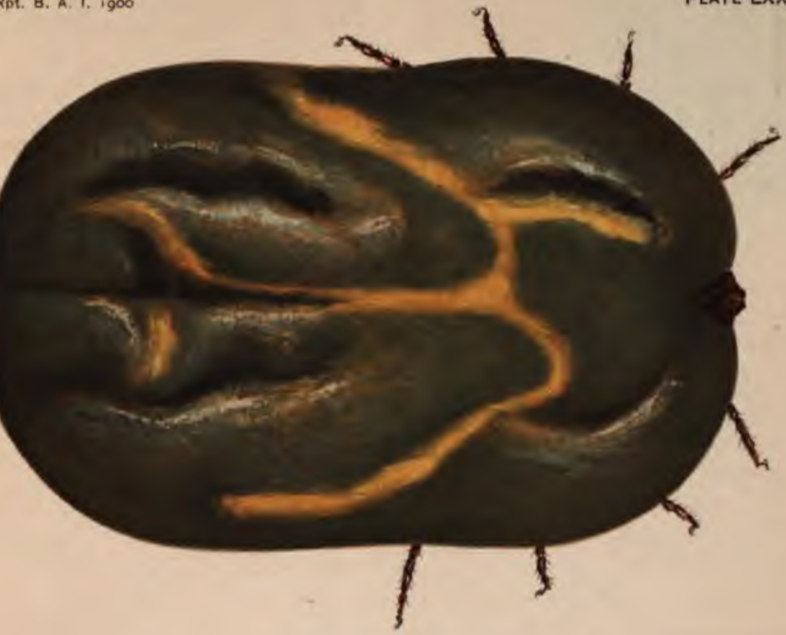
ARTIFICIAL KEY TO EIGHT TICKS REPORTED FROM CATTLE IN THE UNITED STATES.

[For the Texas fever tick, follow Roman type.]

1. Scutum present .... 2.
   Scutum absent .... 5.
2. Scutum uniformly dark, or nearly so .... 3.
   Scutum partially white or yellow .... 4.
3. Palpi less than half as long as the capitulum is broad ...... *Boophilus annulatus*, p. 420.
   Palpi as long as the capitulum is broad, or even longer ...... *Ixodes ricinus*, p. 462, *and I. hexagonus*, p. 467.
4. *A single bright spot at posterior angle of female scutum* .... *Amblyomma americanum*, p. 474.
   White extends to anterior portion of female scutum .... *Dermacentor electus*, p. 455, *and D. reticulatus*, p. 448.
5. *Found in the ear; body violin-shaped* .... *Ornithodoros Megnini*, p. 408.
   Body oval; tegument with radiate lines of dots .... *Argas miniatus*, p. 402.

It is needless to state that this key is given only as an additional aid, in the way of a "ready reference," to help inspectors to become more familiar with the species. If a determination is made by means of

PLATE LXXV.



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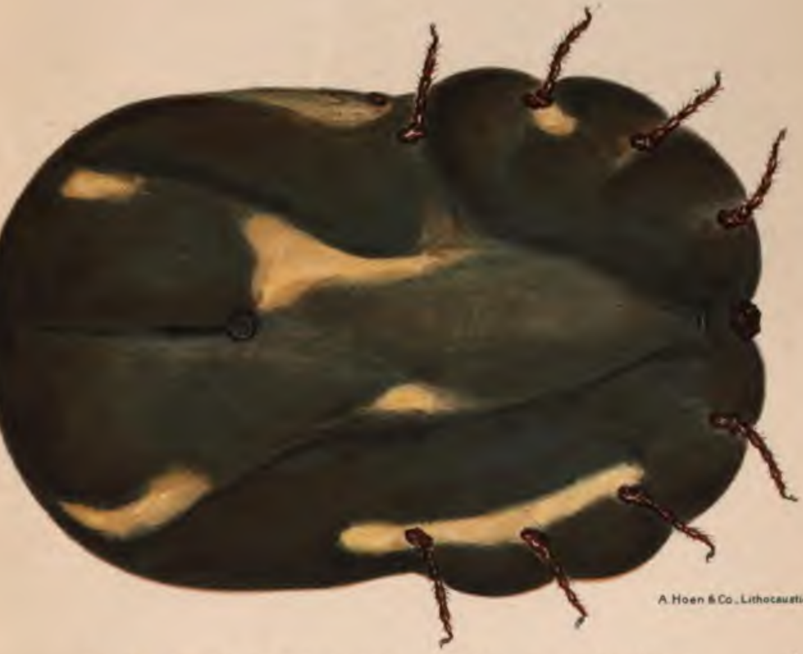

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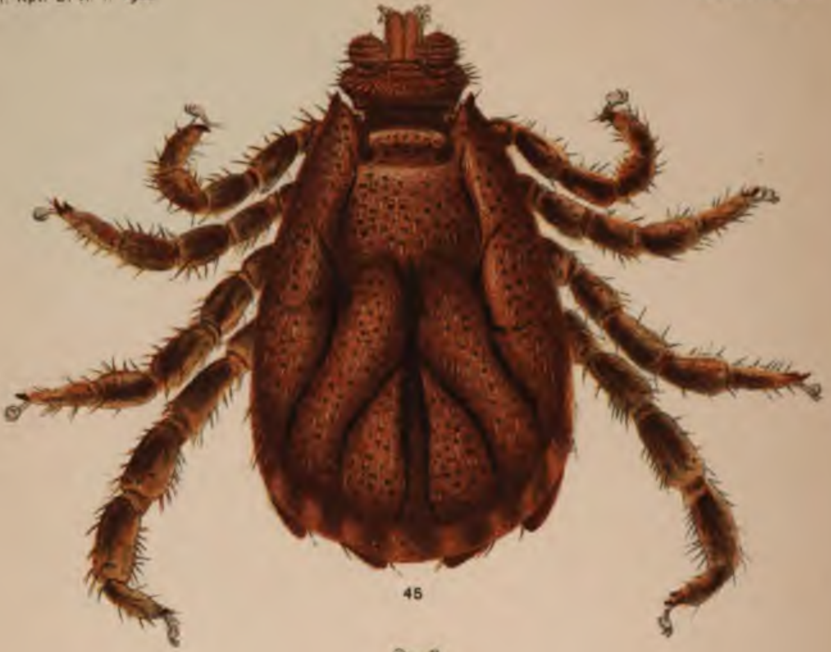
A. Hoen & Co., Lithocaustic

FIG. 43. DORSAL VIEW OF REPLETE FEMALE BOOPHILUS ANNULATUS. GREATLY ENLARGED. ORIGINAL.

FIG. 44. VENTRAL VIEW OF SAME.



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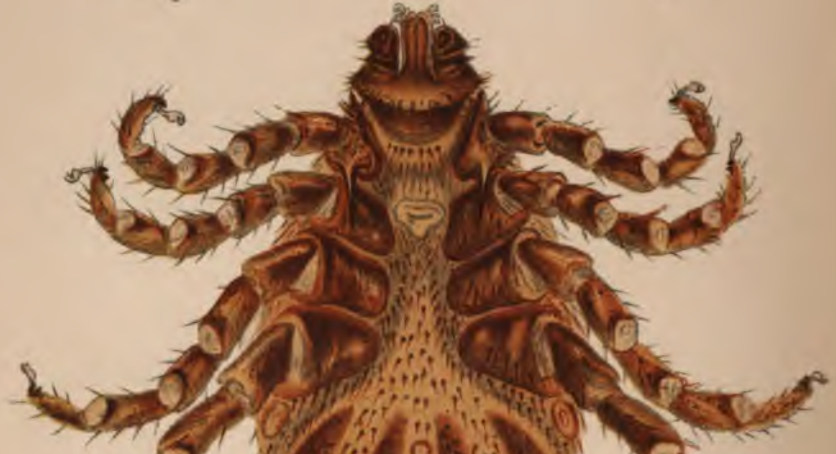

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A Hoen & Co. Lithocaustic

FIG. 45. DORSAL VIEW OF MALE BOOPHILUS ANNULATUS OF THE UNITED STATES. GREATLY ENLARGED. ORIGINAL.

FIG. 46. VENTRAL VIEW OF MALE BOOPHILUS ANNULATUS OF THE UNITED STATES. GREATLY ENLARGED. ORIGINAL. THE SPINES ON COXÆ I ARE UNUSUALLY LARGE.

PLATE LXXVI.

FIG. 45.—Dorsal view of male *Boophilus annulatus* of the United States. Greatly enlarged. Original.

FIG. 46.—Ventral view of male *Boophilus annulatus* of the United States. Greatly enlarged. Original. The spines on coxæ I are unusually large.

this artificial table, it should, of course, be verified by means of the illustrations, the more detailed keys, or the descriptions.

It may here be mentioned that the common sheep tick was formerly supposed to be closely related to the cattle ticks and dog ticks, and in the writings of pre-Linnæan authors the terms lice, ticks, *Reduvius*, and *Ricinus* cover much more than they do to-day. Even Linnæus as late as 1761 mentions the sheep tick (*Melophagus ovinus*) as an acarine (*Acarus reduvius*). Gradually, however, by the process of elimination, the sheep tick has been placed where it belongs—in the insects—but it has still retained its old vernacular name which it has had for several centuries.

THE GENERAL STRUCTURE OF TICKS.

In order properly to determine a tick it is necessary to become acquainted with the general anatomical parts, particularly with the external anatomy, and to understand the technical terms used. Unfortunately there is considerable confusion in regard to the terminology as adopted by various authors. This is largely due to attempts to homologize the various structures of the tick with corresponding structures of the insects. The terminology used in this paper may be seen from figs. 43 to 68.

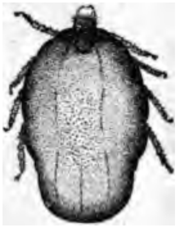


FIG. 47.—Dorsal view of nymph of *Boophilus annulatus* of North America. Greatly enlarged. Original.

The ticks are air-breathing arachnoids, which are always large enough to be seen with the naked eye; young specimens just born are very small, but still visible without the aid of a microscope; fully replete forms may be over half an inch in length. Several different forms are recognized in each species, as given below:

Adult or replete females (figs. 43, 44), which have eight legs.

Adult males (figs. 45, 46), also with eight legs, usually somewhat smaller and flatter than the females.

Nymphs (fig. 47), which are half-grown eight-legged females.

Larvæ (figs. 48, 49), which are six-legged and without sexual orifice.

Eggs (fig. 50), which have a rather hard, leathery shell.

Young specimens and males are rather flat; females become rounded and plump with increasing age.

Upon even a superficial examination it will be noticed that ticks are composed of two more or less distinct portions united by an articulation. These parts are known as the *capitulum*, or *head*, and the *body*. By using these terms in this manner we do not intend to imply that all of the parts of the head of the insects are contained in the capitulum.

I. CAPITULUM, OR HEAD.—The capitulum (figs. 52–54), also known as the head or the rostrum, is the small anterior structure with the mouth parts; it is attached to the anterior extremity (figs. 45, 46) in the family Ixodidæ and in the larvæ (fig. 101) of the family Argasidæ. It is hidden under the anterior extremity (fig. 71) in older stages of the family Argasidæ. Several different parts may be distinguished, as follows:

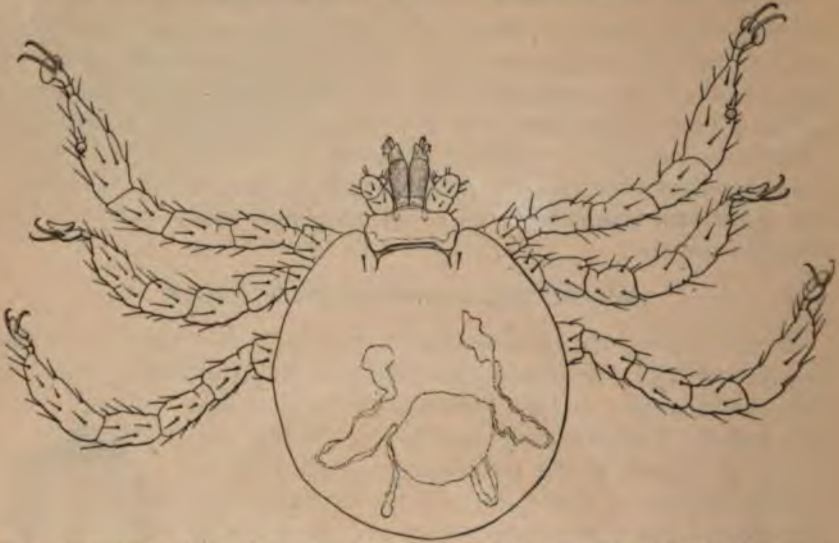


FIG. 48.—Dorsal view of larva of *Boophilus annulatus* of North America. Greatly enlarged. Original.

(1) The *base of the capitulum* (capituli basis, mouth shield) is the hard basal portion (fig. 54) which is articulated proximally by a neck-like structure (fig. 54) in the emarginated antero-median portion (camero-

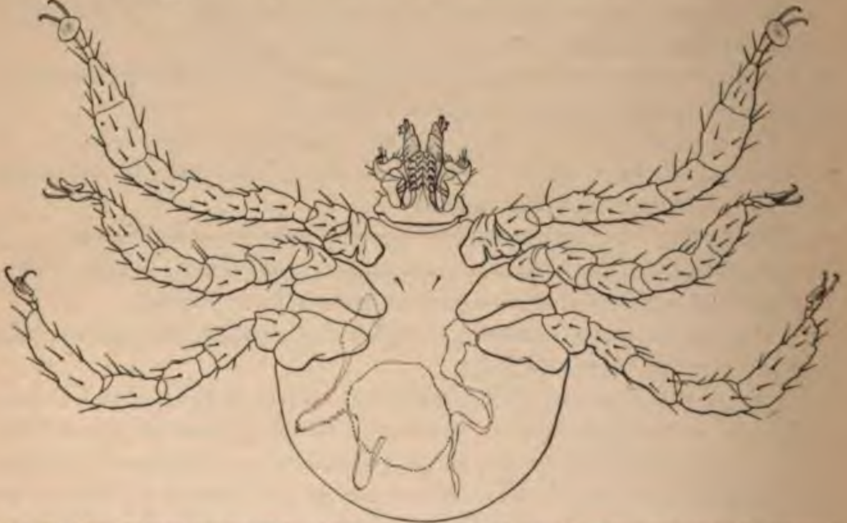
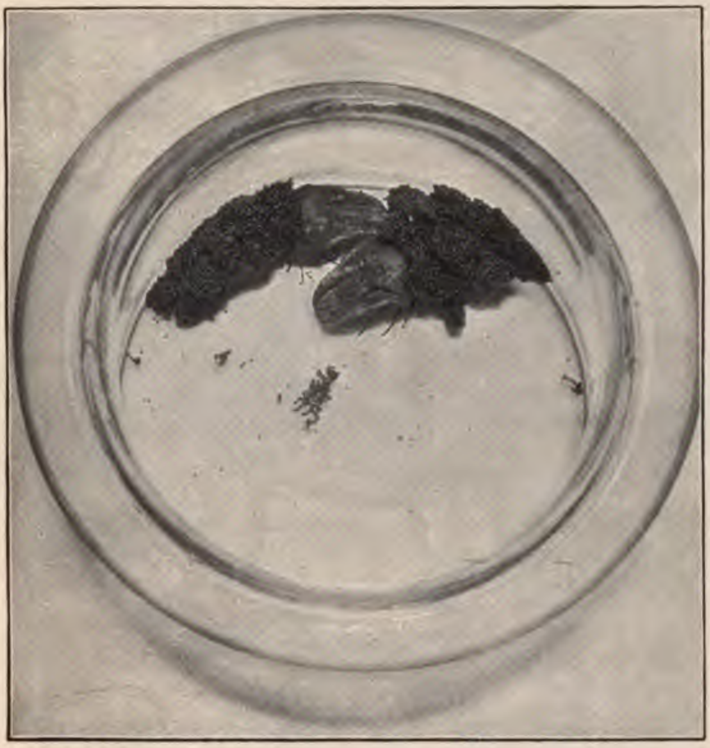


FIG. 49.—Ventral view of larva of *Boophilus annulatus* of North America. Greatly enlarged. Original.



TWO FEMALE TICKS (HYALOMMA ÆGYPTIUM) OVIPOSITING. NATURAL SIZE.
(Photograph by J. E. Emery.)

stome) of the body (fig. 54) and scutum. Viewed from above, it usually presents a square to elongate surface, the postero-lateral corners (fig. 54 *p. l.*) of which are often sharply pointed and spine-like. The outline varies in different species and genera. In some cases it presents a sharp lateral projection. In the females two *porose areas* (areæ porosæ, fovæ porosæ) are found on the upper surface (fig. 60). These structures have different outlines in different kinds of ticks, and are occasionally mistaken for eyes. Anteriorly the base bears the mouth parts (fig. 54) or oral appendages known as the *hypostome*, *mandibles*, *mandibular sheaths*, and *palpi*. The hypostome, mandibles, and mandibular sheaths, are together sometimes called the *haustellum* (proboscis, or, with some authors, the rostrum). In some writings the terms proboscis and rostrum also include the palpi.

FIG. 50.—Egg of *Boophilus annulatus* of North America. Greatly enlarged. Original.

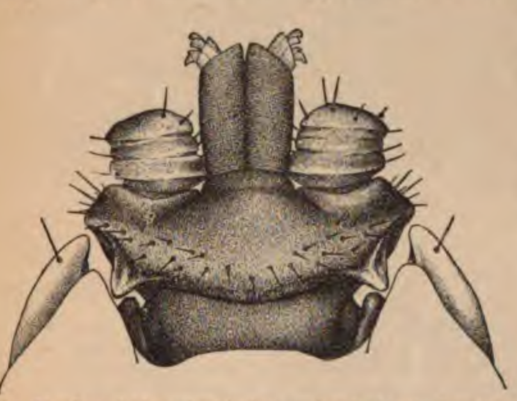


FIG. 52.—Dorsal view of capitulum, or head, of male *Boophilus annulatus* of North America. Greatly enlarged. Original.

(2) The *hypostome* (tongue, labium, or radula) (fig. 54) lies ventrally underneath the mandibles, and is best seen on ventral view. It is an elongate dart or spatulate structure, which is composed of two lateral symmetrical halves (figs. 53, 55). Its ventral surface is armed with numerous minute teeth, called *denticles*, their points being directed toward the body. As a rule there are numerous denticles at the tip, which are not arranged in distinctly regular rows. A short distance from the tip the denticles become larger and are arranged in quite regular longitudinal rows. In most species these rows are so placed that the corresponding denticles of each row form a more or less regular transverse row. The number of longitudinal rows varies in different species, and forms an

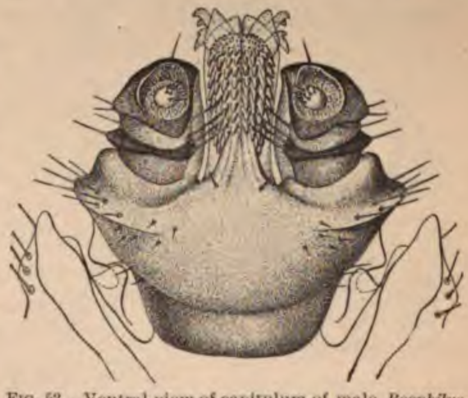


FIG. 53.—Ventral view of capitulum of male *Boophilus annulatus*. Greatly enlarged. Original.

important character for classifying ticks. Thus, in the Texas fever tick (*Boophilus annulatus*), found in the United States, and in the corresponding tick (*B. australis*) found in Cuba, Porto Rico, certain parts of South America, India, and Australia, there are eight rows—four rows on each half. In *Boophilus decoloratus*, of South Africa, there are six rows—three rows on each half. Now and then a tick is met with which varies slightly from the general rule, thus resulting in some difficulty in determination. Quite recently, in a sending of ticks from Cuba, all the males corresponded with the males of *B. australis*, but one individual presented six rows of denticles instead of eight.

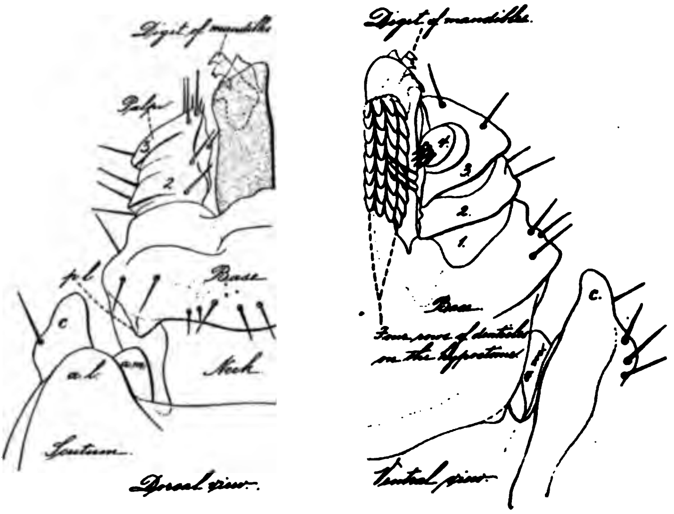


FIG. 54.—Outline drawing of dorsal and ventral views of one-half of capitulum of male *Boophilus annulatus*. Note the following parts: Base with *p. l.*, posterior lateral projection; palpi, *1, 2, 3, 4*, first, second, third, and fourth palpal articles; digit of mandibles; sheath of mandibles; four rows of denticles on hypostome. The neck and front part of the body are also shown; scutum, with *a. l.*, antero-lateral projections, and *a. m.*, antero-median projections; *c*, anterior projection of coxa I. Greatly enlarged. Original.

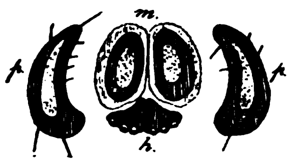


FIG. 55.—Transverse section through the mouth parts of *Hyalomma ægyptium*: *p*, palpi; *m*, mandibles; *h*, hypostome with denticles. After Neumann, 1892a, p. 93, fig. 54.

(3) The *mandibles* (cheliceræ, or jaws) are two in number, representing a pair of elongate structures (fig. 56), one of which is situated on each side of the median line, both lying dorsal (figs. 53–55) of the hypostome. They may be seen either in dorsal or in ventral view of the capitulum, and occasionally appear as if they were a part of the hypostome, thus leading to confusion. A slight pressure, however, usually separates them more distinctly from the hypostome. The *proximal half* or *third* is swollen to contain the muscular insertions. The *distal half* or *two-thirds* is flat and narrow and terminated anteri-

orly by a *digit*, which is recurved at its anterior free extremity in a dorsal hook. This digit bears either two or three processes, known as the *apophyses*, which are unequal in size—the *internal* or lesser apophysis, the *external* (away from the median line) or greater apophysis, and the *middle* apophysis—situated between the internal and the external. Each apophysis bears one or more thorn-like or hook-like teeth, more or less recurved toward the base of the capitulum. Some authors attach considerable importance to the number and arrangement of these teeth in classifying ticks. Our own experience has been that the teeth of the external apophysis are subject to variation among the individuals of given species, hence not reliable as systematic characters; while the teeth of the internal apophysis are usually so difficult to recognize with certainty that, whatever may be their systematic value, we are disposed to select other characters.

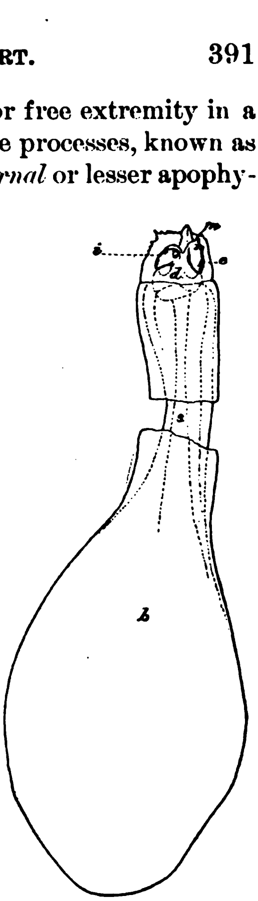


FIG. 56.—Dorsal view of mandible of *Argas miniatus*, showing the base *b*, stem *s*, digit *d*, external *e*, internal *i*, and median *m* apophyses. Greatly enlarged. Original.

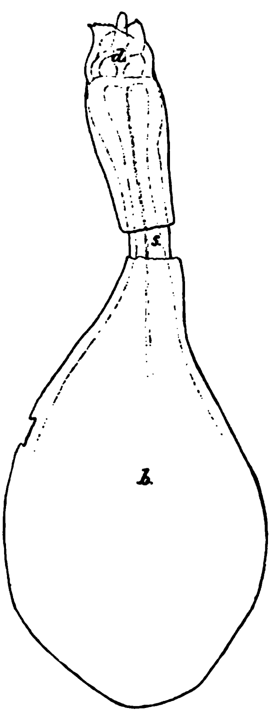


FIG. 57.—Ventral view of same. Original.

(4) The *mandibular sheath* (figs. 54, 55) lies dorsal of the mandibles, and often appears as though it were a direct prolongation of the base of the capitulum. The sides are curved ventrally at the sides of the mandibles. The anterior extremity is notched in the median line, and a distinct line (fig. 52) can often be traced from this point to the base of the capitulum, while a slight pressure not infrequently results in separating the structure into two distinct halves corresponding to the mandibles. Examination under a microscope often reveals numerous fine structures on the exposed surface, giving to it the appearance of a file.

As stated above, the hypostome, mandibles, and mandibular sheaths, taken together, represent the haustellum (sometimes called the beak). These are the structures which are inserted into the skin of the animal (fig. 54) upon which the ticks are parasitic. The arrangement of the denticles and teeth, with points directed toward the tick's body, enables the parasites to hold so firmly to their victim that it frequently happens that the capitulum is torn from the body of the tick and left in the skin of the host when an attempt is made to remove the parasites by force.

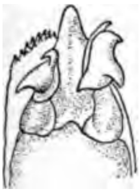


FIG. 58.—Digit of mandible of same. After Neumann, 1896, p. 10, fig. 9.

(5) The *palpi* (figs. 52–55) are inserted on the base of the capitulum, in some cases rather dorsally, in others rather ventrally, one on each side of the haustellum. Each *palpus* is composed of four *articles* joined together in a row by *articulations* (fig. 59). These articles are called: *First*, or *basal*, *article* (nearest the base of the capitulum); *second*, or *antepenultimate*, *article*; *third*, or *penultimate*, *article*; and, *fourth*, or *apical*, *article*. They are more or less excavate on their median or internal side (the side toward the mandibles and hypostome), so that they form a more or less distinct sheath to these structures. Their *ventral*, *dorsal*, *lateral* (or *external*), and *median* (inner) aspects vary in appearance in different ticks.

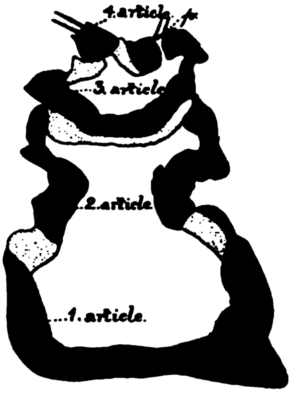


FIG. 59.—Longitudinal section through a palpus of *Boophilus annulatus*. The articles are black, the articulations dotted. Note the pore (*p*) which pierces the entire cuticle. Original.

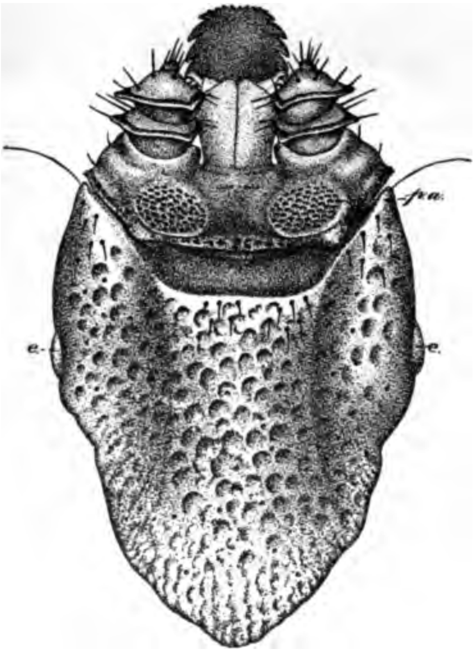


FIG. 60.—Scutum and scutellum of female *Boophilus annulatus*, showing mouth parts, porose areas (*p. a.*), and eyes (*e*). Greatly magnified. Original

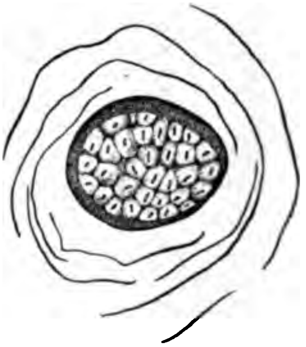


FIG. 61.—Dorso-submedian porose plate of *Dermacentor reticulatus*. Greatly magnified. Original.

The palpi are provided with *hairs*, *bristles*, *edges*, *angles*, and *spines*, which vary in different ticks.

The form of the palpi is an important character in classifying ticks in their respective genera.

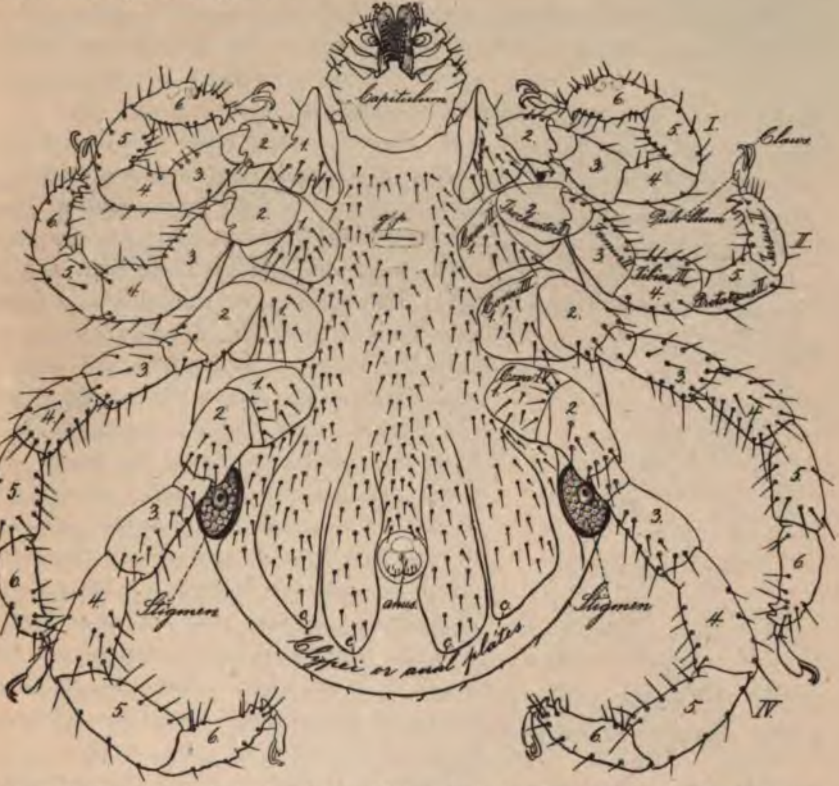


FIG. 62.—Outline ventral view of male *Boophilus* to show structures used in classification: anus; clypei or anal shields; *g. p.*, genital pore; legs I to IV; the names of the articles are written on the leg II. Greatly enlarged. Original.

II. BODY.—The body (figs. 42–49) varies greatly in form, being different in color, outline, and structure, not only in the different genera and species, but also in the two sexes of the same species and in the different stages of the same sex. This extreme variety of appearance has led some observers to describe the different members of one and the same species as representatives of different species, and accounts to a great extent for the confusion in the classification. An individual specimen, if alive, will even change color while it is being studied.

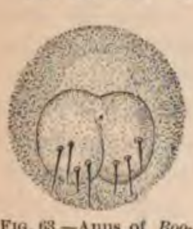


FIG. 63.—Anus of *Boophilus annulatus*. Greatly enlarged. Original.

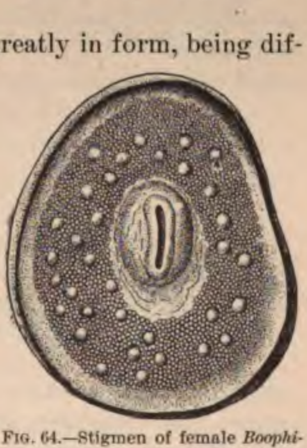


FIG. 64.—Stigmen of female *Boophilus annulatus*. Greatly enlarged. Original.

Species based upon color alone must, therefore, usually be viewed as probably invalid.

On the body may be recognized *dorsal surface*, *ventral surface*, *sides*, or *lateral margins*, and *anterior* and *posterior margins*, all of which possess structures which are of systematic importance.

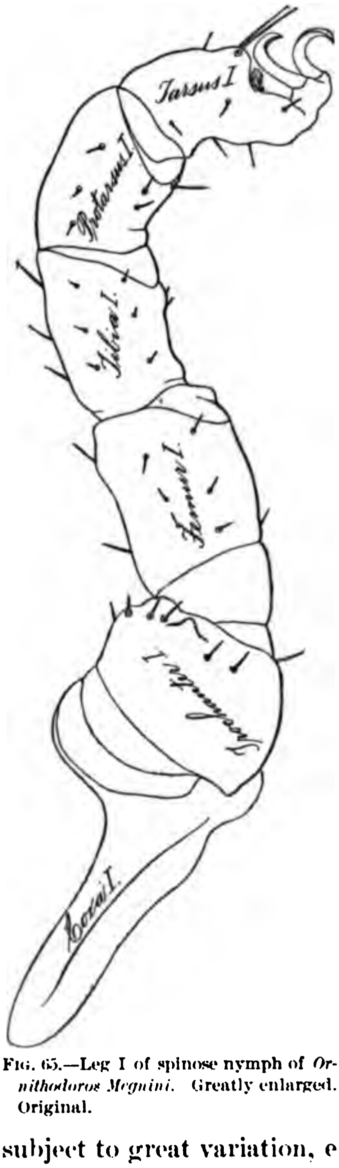


FIG. 65.—Leg I of spinose nymph of *Ornithodoros Megnini*. Greatly enlarged. Original.

A. DORSAL STRUCTURES.—On the dorsal surface are found: *Scutum* (dorsal shield), *eyes*, *dorso-submedian porose plates*, *postero-marginal festoons* and *shields*, *furrows*, *pits*, *punctations*, and *hairs*.

(1) The *scutum*, or dorsal *shield* (also called thoracic shield, dorsal plate, occasionally erroneously called the head), characteristic for the family Ixodidæ, but not found in the family Argasidæ, is a hard leather-like plate on the back. In the male (fig. 43) it usually covers the entire or almost the entire dorsal surface; in nymphs (fig. 47), it covers the anterior portion; and, on account of its size in proportion to the size of the body, nymphs are occasionally mistaken for males. In the adult female (fig. 43), it is proportionately much smaller and confined to the anterior end of the body. Usually it is more or less distinctly divided by two longitudinal *cervical grooves*, which are of some systematic importance. Its anterior portion may be more or less distinctly emarginate to receive the base of the capitulum, in which case one or two pairs of antero-terminal prolongations (fig. 60) of the scutum are present. The scutum may bear coarse or fine pores (punctations) with or without hairs; it may be quite uniform in color, or may be more or less highly colored by the presence of a *rust* of metallic luster, giving rise to various designs. The latter are subject to great variation, even among different members of the same species, and while they are often useful in *aiding* in the recognition of a species, they can not be admitted as of prime specific value. Under no circumstance, so far as can be seen at present, should these color designs alone be taken as basis for establishing new species.

(2) *Eyes* (fig. 60) are not present in all forms. When present they are visible as small, smooth, more or less semiglobular structures, one on each lateral margin of the dorsal shield in the case of Ixodidæ; or punctiform structures on the supracoxal fold near coxæ I, in the Argasidæ.

(3) The *dorso-submedian porose plates* (fig. 61).—It is not yet determined how generally these are found in different forms, but we have observed them in the genera *Dermacentor*,[1] *Rhipicephalus*,[2] *Boophilus*,[3] and *Hyalomma*.[4] They are small circular or oval chitinous structures situated one on each side of the median line near the planes of legs III and IV. Examined under a high power, they are seen to be composed much like the stigmata of a ring which incloses a number of wart-like elevations, each of which bears on its summit an elongate pore. The function of these structures is not determined. They occur in both sexes.

(4) The *postero-marginal festoons* (fig. 169) are not present in all forms. When present, eleven may usually be more or less distinctly recognized.

(5) The *dorsal furrows* (fig. 43) run longitudinally and are due to the insertion and contraction of the dorso-ventral muscles. They are not always distinct, changing with the repletion of the tick and with the muscular contractions. They are described in great detail by some authors, who apparently attach considerable importance to their arrangement.

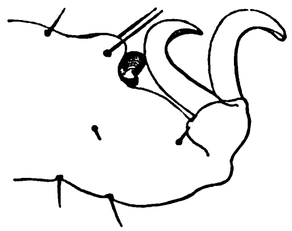


FIG. 66.—Tarsus I of *Ornithodoros Megnini* with sense organ. Greatly enlarged. Original.

(6) *Pits*, *punctations*, *hairs*, *spines*.—If a microtome section is made through the cuticle of the tick, it will be seen that the tegument is pierced by numerous pores, at the base of which are situated large, peculiar gland cells, and from which issue hairs. On a surface view these pores are seen as circular bodies of various sizes, and the hairs or spines may be easily distinguished by means of a good hand lens.

B. VENTRAL STRUCTURES.—On the ventral surface are found: *Genital pore*, *anus* with *anal valve*, *anal shields*, *ventral shields*, *stigmata*, *furrows*, or *grooves*, *legs*, *pits*, *punctations*, and *hairs*.

(1) The *genital pore* (fig. 62) is situated in the ventro-median line. It is a transverse slit, more or less anterior, between the bases (coxæ) of the first three pairs of legs. It is not present in the hexapod larvæ.

(2) The *anus* (fig. 62), surrounded by a chitinous anal valve, is in the ventro-median line, posterior of the last pair of legs.

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[1] *Dermacentor reticulatus*; *D. variegatus*; *D. electus*; and *D. nitens*.

[2] *Rhipicephalus sanguineus*; *R. bursa*.

[3] *Boophilus annulatus*; *B. australis*.

[4] *Hyalomma ægyptium*.

(3) The *anal shields*, or *plates* (clypei), (fig. 62) are present only in the male of certain genera. They are elongate in form, four in number, and are lateral of the anus. Certain forms (*Ixodes*) also have other *ventral shields*.

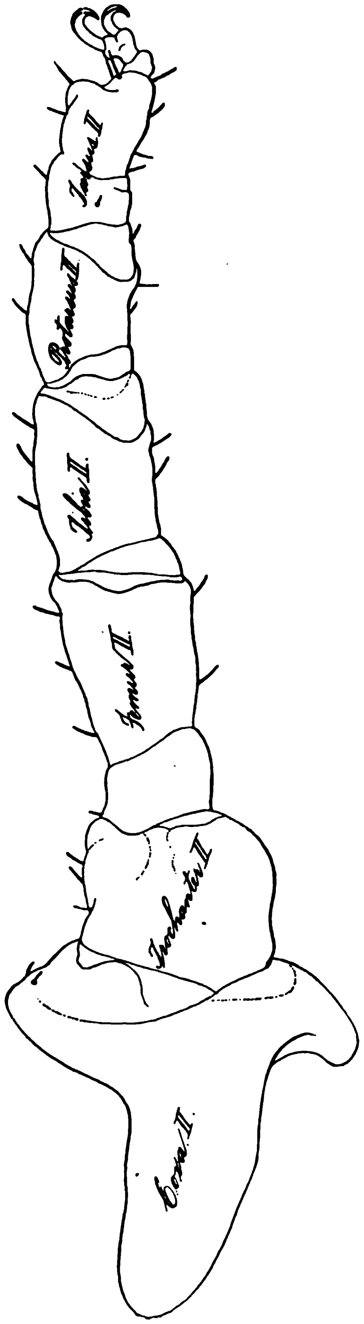

FIG. 67.—Tarsus II of spinose nymph of *Ornithodoros Megnini*. Greatly enlarged. Original.

(4) The *stigmata* (stigmal plates, or peritremes) are two in number (fig. 62), lateral or slightly ventral, one on each side of the body. In the Argasidæ they are between the III and IV pairs of legs; in the octopod stages of the Ixodidæ they are back of the IV pair of legs. It is usually stated that they are not present in the hexapod stage, but in certain forms (as in *Boophilus annulatus*) they are present (fig. 62), being situated between coxæ II and III. We have frequently found larval ticks which presented three pairs of stigma-like structures: One pair between coxæ I and II; a second pair between coxæ II and III; and a third pair, which appears to be either double or to be close to an unusually prominent chitinous ring, posterior to coxæ III.

The stigmal plates vary in form and structure in the different species and are important systematic characters. We may recognize the entire structure as the *stigmal plate*, or peritreme, with a *stigmal surface*, with an opening known as the *stigmal aperture*, or *spiracle*.

(5) *Furrows* and *grooves*.—Various furrows or grooves (fig. 62) may be recognized on the ventral surface. The most important of these are a pair of *genital furrows* and the *anal furrow*. The former extend, one on each side of the median line, from the region of the genital pore backward, diverging back of coxæ IV, and ending near the postero-lateral margins.

(6) *Pits*, *pores*, *punctations*, *hairs*, *and spines*. —(See p. 395, under "Dorsal structures.")

(7) *Caudal appendage.*—In some species, as in *Boophilus australis* (fig. 62), a distinct chitinous caudal prolongation is present.

(8) *Legs.*—The legs (fig. 68) are eight in number in the nymphs and the adult males and females (octopod forms), and six in the larvæ (hexapod form). They are arranged in pairs, which are numbered I to IV. They are composed of six *articles* united by *articulations*. By the formation of *pseudo-articulations* the third article (*femur*) and the sixth article (*tarsus*) may divide into double articles, thus giving eight to the entire leg. The various articles are named as follows, beginning at the end near the body:

First article, or *coxa*, which lies flat on the body and is not movable; in some forms it develops into large plaques, or shields. It may be provided with more or less prominent *spurs*, or *teeth* (fig. 62), in which case it is often spoken of as *dentate*, *bidentate*, etc.

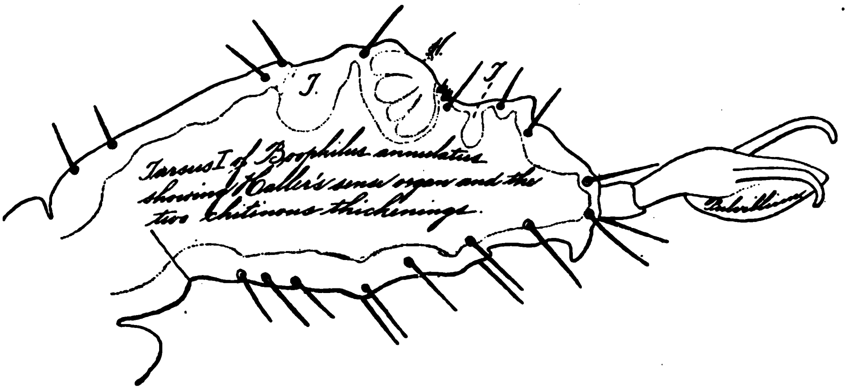
J.
H.
J.
Tarsus I of Boophilus annulatus showing Haller's sense organ and the two chitinous thickenings.
Pulvillum

FIG. 68.—Tarsus I, claws and pulvillum of *Boophilus annulatus*. Greatly enlarged. Original.

Second article, or *trochanter*, a short article, may be broader than long.

Third article, or *femur*, an elongate article, which by the formation of a pseudo-articulation (at its proximal end, nearest the trochanter), may present a double article.

Fourth article, or *tibia*, elongate.

Fifth article, or *protarsus*, elongate.

Sixth article, or *tarsus*, which may form a pseudo-articulation at its proximal or at its distal end; it is the article the furthest removed from the body and bears at its distal extremity a stalk with two claws, which in the family Ixodidæ bear on their ventral surface an umbrella-like or disk-like membranous expansion known as the *pulvillum*.

The tarsi of the first pair of legs are also provided near their distal extremity with a cupuliform sense organ, *Haller's organ*, which is supposed to be an organ of hearing (fig. 68).

The corresponding articles of the different pairs of legs are numbered the same as the legs, coxæ I to IV, tarsi I to IV, etc., meaning the coxæ or tarsi of the first, second, third, or fourth pair of legs, respectively.

THE LIFE HISTORY OF TICKS.

Ticks are temporary parasites, attacking mammals, birds, and reptiles. They do not appear to be so strictly confined to certain hosts as do parasites in general. Still, this may be more of an apparent than a real rule. Certain it is that, although a given tick may be found occasionally on animals which are very dissimilar (dog ticks have, for instance, been found on snakes), still the various species show a decided predilection for certain hosts.

The parasites copulate during the period of parasitism, and suck the blood from their hosts. The female grows to a large size and eventually drops to the ground and lays numerous eggs, which are usually more or less clustered together. The larva upon hatching possesses three pairs of legs, the fourth pair being added during a molt. Either the hexapod or the octopod form may attack its host.

In case of the Texas fever tick the details of the moltings have been established by Curtice (1892, pp. 238, 239–241) as follows:

> The following table will serve to illustrate the sequence of events in the experiment and present it in rough but compact form:

Date.	Stage of experiment.	Time consumed in various stages.
1889.		
Oct. 3	Egg laying begun	
Oct. 10	Egg laying finished	Ovipositing one week.
Nov. 4	Ticks appeared	Hatching, three and four weeks.
Nov. 15	Rearing begun	Unnecessary interval of one week.
Nov. 22	First molt, larva to nymph	Larval stage lasted one week.
Nov. 29	Second molt, nymph to adult	Lasted one week.
Dec. 11	Female half grown with male	About two weeks later.
Dec. 16	Experiment closed	About one week.
	Experiment endured	About two and one-half months.

> Having briefly reviewed the experiment we may now study its products.
>
> The eggs were laid in a little mass; were subovid, dark brown and opaque, and coated with some protective substance. In alcohol they show a thin shell-like covering with a dark opaque mass within. In the latter stages of incubation the form of the young ticks became more and more apparent until they emerged. The exit from the shell seemed to be by the shell rupturing and the imprisoned occupant thrusting it off with its feet. The torn edges afterward rolled inward and produced the appearance of clam shells, so frequently mentioned in writings on this subject.
>
> * * * * * * *
>
> The young ticks, or larvæ, when they emerge are whitish, they gradually turn to chestnut brown and resemble minute seeds. Though I have never seen the seed ticks of the South since I have begun to study them from a standpoint other than to rid myself of them, I think that the young of the cattle tick may form a large portion of them.
>
> The date of the first collection, November 22, was a week from the time the young ticks were put on the calf, and very fortunately coincided with the time of the first

molt. Specimens were taken which showed the tick nearly ready to emerge from the old skin, through which they could be seen. The larva (Mégnin) is six-footed, possesses no sexual organs, and wants the large single stigmata found in later stages. I think it breathes through the six stigmata-like dots I have observed on the sides just behind each pair of limbs, but I have not yet made all the sections and examinations necessary to sustain this point. The digestive and urinary tracts and cloacal pore are present, and apparently vary little in the successive stages.

The next, or nymphal, stage, as seen through the skin of the larva, has added a pair of limbs behind the others and a pair of large stigmata behind them. The additional legs lie along the sides in a loop with its convexity directed caudally. The contents of the three front pairs of legs have withdrawn until only their white tips remain in the testa about to be molted. The head itself is withdrawn from the external skin and the mouth parts seem to be entirely disconnected from it.

Molting in this stage is completed by the testa first splitting along the side in the vicinity of the head, the feet being thrust out through it, and the dorsal and ventral halves torn apart by the force of the limbs. Specimens of the loose valves and a tick with its feet thrust through the slit near the head, which are now in the Bureau collection, demonstrate this satisfactorily.

In the change from the larval to the nymphal stage there is a complete ecdysis, accompanied by the addition of new parts. The change is therefore incomparable to the stage of metamorphosis in insects, and the terms *larva* and *nymph* can only be used in a restricted sense as applied to these stages as being analogous, but not homologous, with those stages bearing the same names among the insects. The important changes at this molt occur in the locomotory and respiratory organs.

The next specimens were collected a week later, on November 29. The collection contained individuals about to change from the nymphal to the adult stage, which, like the others, could also be seen through the testa they were about to shed. I had previously been enabled to study this stage from field collections, but the specimens collected at this time were invaluable in completing the life history of the ticks as learned from a single brood.

The molting at this period is complete. The limbs and head are withdrawn a little from the old testa. The valves split along the sides as in the earlier molt. The digestive and respiratory and locomotory organs undergo little if any modifications. The greatest change occurs in the reproductive organs, which have developed during the nymphal stage and assume their functions immediately after theecdysis, when the genital orifices appear in the new skin. Beyond this and the more decided adult characters offered in conformation there seem to be no essential changes.

The differences between the ticks destined to become either male or female during their final molt is not marked. The average of the males is smaller, but a small female may not be any larger than an ordinary male. In each the mouth ring and mouth parts, the shield-like headpiece, the breathing pores, the limbs, and the body are alike.

After they emerge, however, the males can be quickly chosen by their smaller size, by the absence of a well-defined head shield, by the extension of the shield over entire back, and by the two pairs of triangular chitinous plates, situated on the abdomen, behind and on each side of the anus. The female looks much as in her earlier stage; the head shield is, however, larger and stronger, the lines made by the muscular attachments to the body walls are stronger and deeper, and the breathing pores are much enlarged. The limbs in both male and female are strong and large as compared with their bodies, and fit them for retaining their place on their host until they have gained a new attachment by their mouth or rostrum. The external genitals which appear in the adults are very similar in each sex and occur between the bases of the second pair of legs. They present little more than an opening situated on the median line of the belly.

Throughout life the male enlarges but little; he becomes a little broader, longer, and thicker, but not markedly so. The female, on the contrary, grows to a comparatively immense size, swelling day by day, her body becoming so rotund and replete with the food drawn from her host that she can scarcely be recognized as of the same species as the males. While her body has inflated, however, her head, legs, and breathing pores have not undergone any changes. These remain exactly of the same size as in the beginning, and with the exception of the head shield are but little different from those of the male. The disparity in size between the legs and the body of the fully gorged female is so marked that the legs and head appear even smaller than at first. The comparatively small size of the male has caused it to be overlooked, or, if found, caused it to be classed among the young of this species.

After molting, the young female again attaches herself to her host, and seems rarely to change her position. While she may be able to do so at first with ease, she becomes so heavy and logy later on that any change would cause her to fall to the ground should she loosen her hold with her beak. The males, however, remain small and light, and it is not impossible for them to change their position, and no doubt do so. After molting they hunt for mates through the dense growth of cattle hairs and, finding them, attach to their host so that they can conveniently embrace them belly to belly, and bring their external genitals in apposition. In this position the males may be found with females of all sizes. That the attachment of the male to the host is for food, as well as to facilitate copulation, there can be but little doubt, for his long continuance of life, his increase in size, and the tremendous drain upon the little fellow in fertilizing the eggs demand it.

Lounsbury (1900) has given a detailed account of a closely allied form, *Boophilus decoloratus*, found in South Africa. This account is reprinted on pages 435–437 of this article.

Family Argasidæ[1] Canestrini, 1892.

Family diagnosis.—*Ixodoidea:* Scutum absent. Capitulum inferior (except in hexapod stage, where it is antero-terminal). Digit of mandibles irregularly triangular, with broad swollen base; internal apophysis more or less transverse, acute at both ends and inserted toward the middle of the digit; middle apophysis almost linear, resting on the back of the external apophysis, terminal tooth pointed outward; external apophysis elongate, nearly parallel to digit, recurved at its base and its apex, in two similar nearly parallel hooks. Palpi free, cylindrical, the four articles rather similar. Legs slightly unequal, pair II being shortest, pair IV longest; femur and tibia (except of pair I) form pseudo-articulations at a distance from proximal end about equal to their diameter; coxæ contiguous or subcontiguous; tarsi of adult without pulvillum. Dorsal and ventral plates (shields, scutum, etc.) absent. Stigmata between III and IV pairs of legs, lateral of coxæ. Genital pore median, at height of II intercoxal interval; male pore narrow, semilunar, nearly as long as broad; vulva an elongate slit, with parallel labia and nearly as broad as capitulum. Sexual dimorphism not very pronounced.

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[1] Synonymy and Bibliography.

1844: Fam. *Argasiden* Koch, 1844, pp. 219, 220.—Idem, 1847, pp. 11, 12.
1846: Fam. *Argantidæ* Agassiz, 1846, p. 32. [See also Marx, 1892, p. 232.]
1861: Fam. *Argasides* Fürstenberg, 1861, p. 208.
1877: Subfam. *Argasidæ* Murray, 1877, pp. 180–184.—Berlese, 1885, p. 131.—Riley, 1887, p. 744.
1880: Tribe *Argasides* Mégnin, 1880, pp. 132–136.
1886: Tribe *Argasinés* Railliet, 1886, pp. 499–502.—Neumann, 1888, pp. 89, 95, 96.—Idem, 1892a, pp. 93, 100, 101.
1892: Subfam. *Argasinæ* Trouessart. 1892, pp. 38, 46, 47.—Railliet. 1893, pp. 704, 715–718.—Neumann, 1896, pp. 2–44.—Ward, 1900a, pp. 196, 197.—Idem, 1900b, pp. 436, 437. [See also Trouessart, 1891, p. 308; misquotation for *Argasidæ*.]
1877: Fam. *Argasini* Canestrini & Fanzago, 1877, pp. 192–194.—Canestrini, 1891, pp. 530–536. [See also Trouessart, 1891, p. 307.]
1892: Fam. *Argasidæ* Canestrini, 1892, pp. 582, 587.—Marx, 1892, pp. 232, 233, 234.—Trouessart, 1892, p. 22.—Salmon & Stiles, 1901, pp. 400–414. [See also Gerstaecker, 1860, p. 464.—Trouessart, 1891, pp. 297, 298.]
1892: Tribe *Argasinæ* Neumann, 1892b, pp. 96, 104, 105.
1892: Group *Catastomata* Marx, 1892, pp. 233, 234.—Morgan, 1899, p. 136.
1893: Subfam. *Argasinés* Railliet, 1893, pp. 715–718.

TYPE GENUS.—*Argas* Latreille, 1796.

There has been considerable difference of opinion as to whether this group is more closely related to *Dermanyssus* and *Gamasus* or to *Ixodes*. At present the consensus of opinion places it nearer *Ixodes*. The majority of recent authors consider the forms in question as representing a subfamily, but it appears to us that the presence or absence of the scutum is such an important character that family rank is not too low. The position of the head as inferior in adults, the position of the stigmata, and absence of the pulvillum from the tarsi of the adult, are also important characters which distinguish the Argasidæ from the Ixodidæ.

GENUS ARGAS[1] Latreille, 1796.

GENERIC DIAGNOSIS.—*Argasidæ:* Body flattened, with oval or orbicular contour; posterior end more bluntly rounded than anterior; broadest portion posterior of coxæ IV. Hood projection above capitulum spread out on the level of the dorsal surface. Lateral margins thin or a little thickened. Tegument not mammillated, but slightly roughened by irregular zigzag wrinkles or folds, which are absent only at certain points occupied by nearly circular pits; the latter are more or less numerous

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[1] SYNONYMY AND BIBLIOGRAPHY.

1796: *Argas* LATREILLE, 1796, p. 178.—IDEM, 1804, p. 53; type, *Acarus reflexus*.—IDEM, 1806, pp. 155, 156.—IDEM, 1829, pp. 288, 289.—IDEM, 1835, p. 512.—LEACH, 1815, p. 397.—RISSO, 1826, p. 182.—HEYDEN, 1826, p. 612.—AUDOUIN, 1832, pp. 413, 414.—SUNDEVALL (1833).—DUGÈS, 1834a, pp. 14, 19.—IDEM, 1834c, pp. 31, 32.—GERVAIS, 1844, pp. 229–233.—IDEM, 1847, p. 351.—KOCH, 1844, p. 219.—IDEM, 1847, p. 12.—GERVAIS & VAN BENEDEN, 1859, pp. 455, 459, 460.—GERSTAECKER, 1860, p. 464.—IDEM, 1863, p. 344.—FÜRSTENBERG, 1861, p. 208.—MOQUIN-TANDON, 1861, pp. 304, 305.—VERRILL, 1870, p. 116.—MÉGNIN, 1876, pp. 288, 295.—IDEM, 1880, pp. 133–136, 320–322.—CONIL, 1877, pp. 27, 28, 29.—IDEM, 1878, p. 101.—MURRAY, 1877, pp. 180–182.—CANESTRINI & FANZAGO, 1877, pp. 193, 194.—BERLESE, 1885, p. 131.—LUDWIG, 1886, p. 612.—RAILLIET, 1886, pp. 499–502.—IDEM, 1893, pp. 715–718.—NEUMANN, 1888, pp. 89, 95, 96.—IDEM, 1892a, pp. 92, 100, 101.—IDEM, 1892b, pp. 96, 104, 105.—IDEM, 1896, pp. 3–25.—BLANCHARD, 1890, pp. 329–339.—CANESTRINI, 1890, pp. 530, 531–536.—IDEM, 1892, p. 582.—TROUESSART, 1891, pp. 290, 291, 292, 293, 294, 295, 300, 305.—IDEM, 1892, pp. 35, 47.—EFISIO, 1892, p. 257.—MARX, 1892, pp. 233, 234.—OSBORN, 1896, pp. 255, 256.—MORGAN, 1899, p. 137.—WARD, 1900a, pp. 196–198.—IDEM, 1900b, p. 437.—SALMON & STILES, 1901, pp. 401–406. [Not to be confused with *Argas* SCOUL., 1835, crustacean; *Arges* HANN., 1835, crustacean; *Arges* GOLDF., 1839, crustacean; *Arges* VAL., 1840, fish; *Argus* BOH., 1761, mollusk;

and scattered; the larger pits may form a radiating series on dorsal and ventral surfaces, a median posterior row being longest. Eyes absent.

TYPE SPECIES.—*Argas reflexus.*

The members of this genus are nocturnal in their habits and nourish themselves by sucking blood of mammals and birds. Neumann mentions eleven species. The most commonly known forms are—

Argas reflexus of pigeons, which occasionally attacks man.

Argas persicus, the Persian Argas, a form which attacks man and poultry.

Argas miniatus, found on poultry and reported once for cattle.

THE CHICKEN TICK (*Argas miniatus*).[1]

(Figures 56–58, 69–81.)

SPECIFIC DIAGNOSIS.—*Argas:* Body usually quite flat and thin, much like a bedbug (*Acanthias lectularia*), but may be swollen so as to be convex both dorsally and ven-

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Argus SCOP., 1777, lepidopteron; *Argus* POLI, 1795, mollusk; *Argus* TEMM., 1815, bird; *Argus* WALK., 1837, arachnoid.]

1796: *Carios* LATREILLE, 1796, p. 177. [See also LATREILLE, 1806, p. 161.—KOLENATI, 1857, p. 16.—CANESTRINI, 1890, p. 480.—NEUMANN, 1896, p. 19.]

1804: *Rhynchoprion* HERMANN (1804, p. 69).—TREVIRANUS, 1831, p. 188. [See also HEYDEN, 1826, p. 612.—LATREILLE, 1829, p. 288.—CANESTRINI, 1890, p. 531.—TROUESSART, 1891, p. 290.—RAILLIET, 1893, p. 715.—NEUMANN, 1896, p. 3.] [Not to be confused with *Rhynchoprion* or *Rhyncoprion* OKEN, 1815, dipteron; *Rhynchoprium* MARX, 1895, arachnoid.]

1806: *Caris* LATREILLE, 1806, p. 161; type, *vespertilionis* [=*Carios* renamed].—IDEM, 1829, p. 290.—RISSO, 1826, p. 182.—HEYDEN, 1826, p. 613.—LATREILLE, 1835, pp. 511, 512.—GERSTAECKER, 1863, p. 343. [See also AUDOUIN, 1832, p. 413.—DUGÈS, 1834c, p. 32.—KOLENATI, 1857, pp. 15–17.—IDEM, 1858, p. 4.—MURRAY, 1877, p. 181.—CANESTRINI & FANZAGO, 1877, p. 184.—HALLER, 1882, p. 312.—CANESTRINI, 1890, p. 480.—TROUESSART, 1891, pp. 290, 292, 293, 294.—NEUMANN, 1896, p. 19.] [Not to be confused with *Caris* FISCH., 1821, col.]

1834: "*Rhyachoprion* Hermann," of DUGÈS, 1834c, p. 32.

1894: "*Argus* Latreille," of FRANCIS, 1894, p. 452.

[1] SYNONYMY AND BIBLIOGRAPHY.

1844: *Argas miniatus* KOCH, 1844, p. 219.—IDEM, 1847, p. 12.—SALMON & STILES, 1901, pp. 402–406, figs. 56–58, 69–81.

1873: *Argas americana* PACKARD, 1873, pp. 740, 741, fig. 68.—RILEY & HOWARD, 1893, p. 267.

1877: *Argas americanus* PACKARD of Murray, 1877, p. 182.—MÉGNIN, 1885, p. 460.—MARX, 1892, p. 234.—IDEM, 1895, p. 199, figs. 3–3k.—HOEHR, 1893, p. 348.—RILEY & HOWARD, 1893, p. 267.—WEBSTER, 1893, p. 149.—HOWARD, 1895, pp. 417, 418.—NEUMANN, 1896, pp. 9–12, 25, figs. 6–11.—OSBORN, 1896, p. 256, pl. III, figs. 3–3k.—WOODS, 1898, pp. 102, 103, figs. 20a–b.—HART, 1899, p. 180.—MORGAN, 1899, p. 137.—WARD, 1900a, p. 197, fig. 2.—IDEM, 1900b, p. 437, fig. 260.—HASSALL, 1900, pp. 496–500, figs. 16–22, pl. XVI, figs. 1–2. [Not "*Argas americanus* Latreille" of ERCOLANI (1859), p. 248; GAMGEE, 1871, p. 219.] [Not "*Argas americanus* De Geer" of MÉGNIN, 1880, pp. 134, 135; *Acarus americanus*, see *Amblyomma americanum*.—DOLLY, 1894, p. 980.] [Renamed *Argas radiatus* RAILLIET, 1893, p. 718.]

1893: *Argas radiatus* RAILLIET, 1893, p. 718 [*Argas americana* Packard, renamed]. [See also OSBORN, 1896, p. 256.]

1894: "*Argus americanus*" (Packard) FRANCIS, 1894, p. 452 (misprint for *Argas americanus*).

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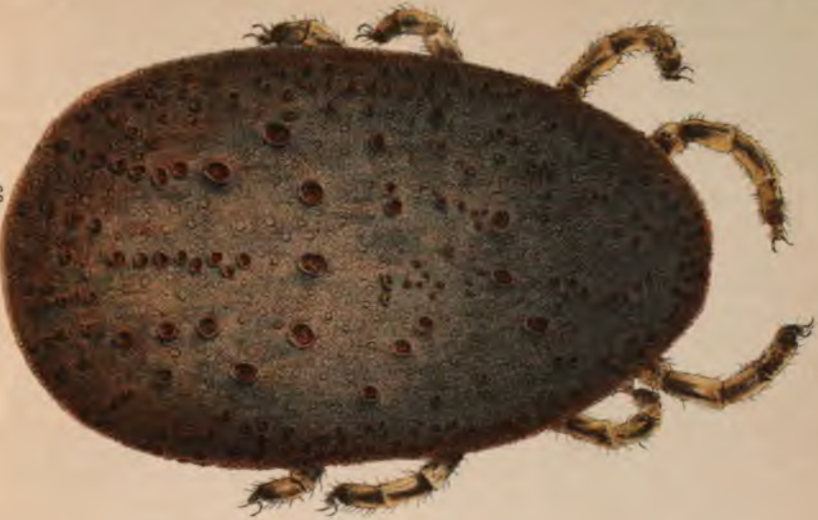

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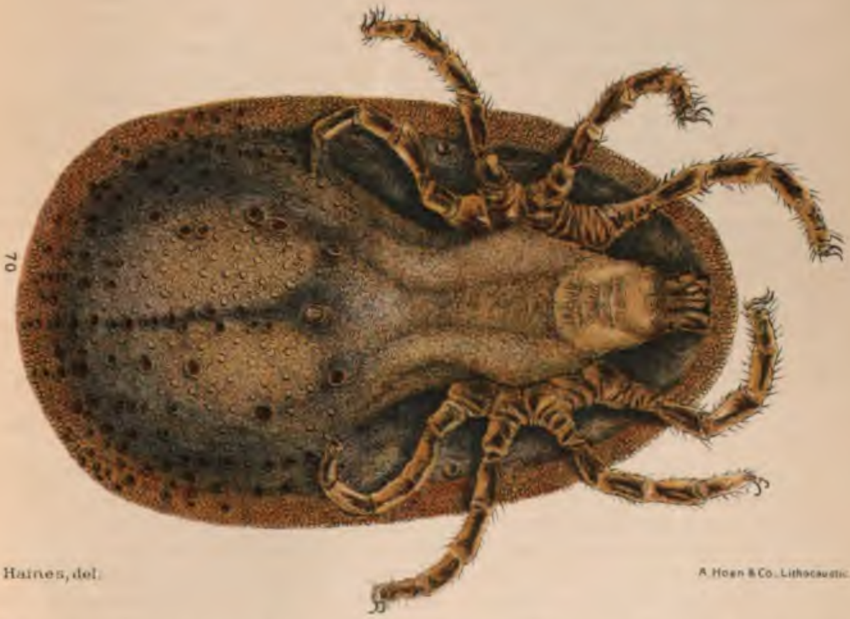

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A. Hoen & Co. Lithocaustic.

FIG. 69. DORSAL VIEW OF ARGAS MINIATUS. AFTER HASSALL, SIXTEENTH AN. RPT. B. A. I., 1900, PL. 16, FIG. 1.

FIG. 70. VENTRAL VIEW OF SAME. AFTER HASSALL, SIXTEENTH AN. RPT. B. A. I., 1900, PL. 16, FIG. 2.

trally, the entire margin being more or less sharp; outline oval; uniform deep reddish brown, legs of lighter color. Tegument rough (shagreened), bearing short, minute, barely visible hairs; on both dorsal and ventral surface there is a marginal row of quadrangular structures, each of which is provided, more or less centrally, with a very short, bristly hair, with a broad base. Numerous glistening pits, both dorsal and ventral, arranged more or less symmetrically and usually in rows radiating from the center. The most prominent are: A semicircle each side of median line, concavity median, on dorso-anterior portion, the entire circle inclosing a slight prominence dorsal of the mouth, the two posterior pits being rather large and oval; postero-lateral of this circle a more or less parallel dorsal crescentic row; then two dorsal somewhat crescentic rows, concavity posterior; a prominent dorso-median and ventro-median row extending from the region of the anus to posterior margin; on each side of median line, both dorsally and ventrally, five or six alternately longer and shorter rows radiating from about the transverse anal plane to the margins; two to three more or less complete marginal rows, dorsally and ventrally. Other smaller pits distributed irregularly. The arrangement of these pits is not absolutely constant. Anus about in middle of body, bordered with six to eight short bristly hairs on each side. Stigmata lateral of coxæ IV, crescentic, concavity posterior and slightly median. Mouth, legs, and genital pore on anterior half of body. Four symmetrically arranged ventral hairs directed forward on base of capitulum, two of them near the base of palpi. Coxæ contiguous, trochanters slightly broader than long; femur long, truncated

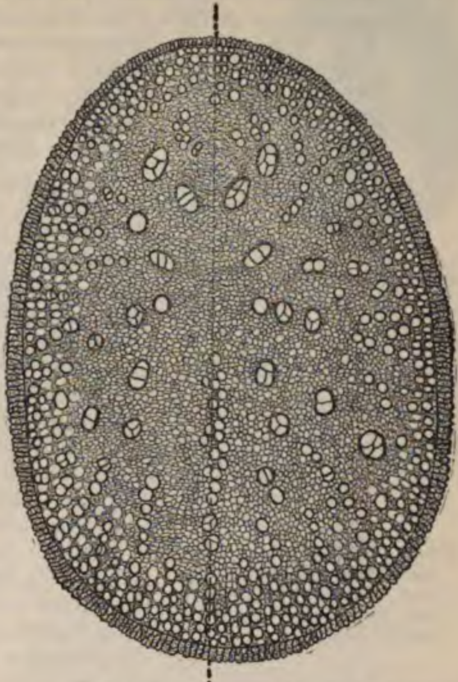

FIG. 71.—Skin of *Argas miniatus*, showing arrangement of the pits. Slightly symmetrical because of pressure. Greatly enlarged. Original.

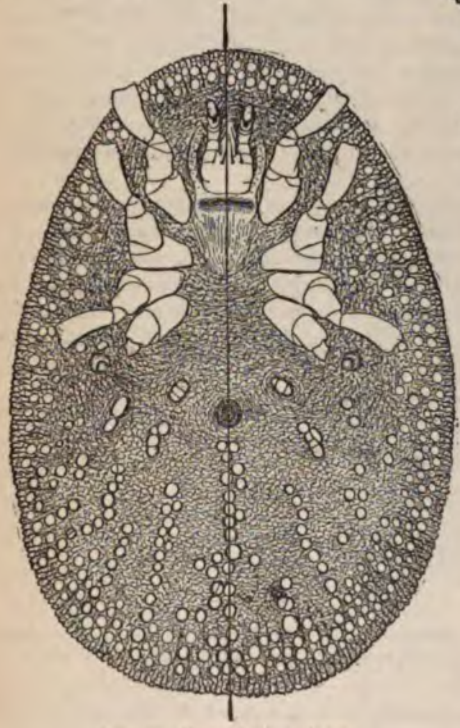

FIG. 72.—Ventral view of same.

conical, its distal extremity somewhat thicker than its proximal; tibia and protarsus cylindrical; tarsus with suddenly attenuated distal extremity and with prominent dorsal protuberance, giving it a hunch-backed appearance, especially on tarsus I; all articles except coxa with short pennate bristles, which become longer near apex of tarsus.

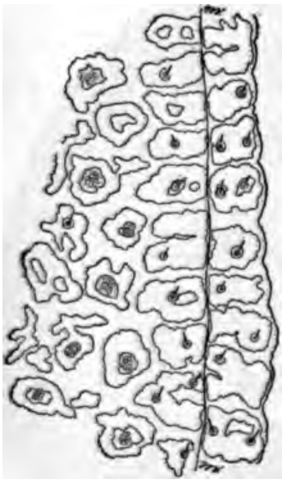
FIG. 73.—A portion of the skin of *Argas miniatus*, showing the marginal line *mm*, with the quadrate structures. Greatly enlarged. Original.

Male.—Attains 4 to 8 mm. long by 2.5 to 5 mm. broad. Capitulum 480 to 500μ broad, 0.3 mm. long from base of the palpi to tip of hypostome. Mandibles 0.9 mm. long, digit 75μ; free portion of stem 325μ; swollen base 500μ long and about 270μ broad; similar in details to *A. reflexus.* Hypostome somewhat indented at apex and bearing on each half 4 small denticles, arranged in transverse rows; then more proximally, 6 large denticles, arranged in two longitudinal rows; finally some smaller denticles, broad but not very salient, on three rows and descending two-thirds the length of the hypostome. Palpi 540 to 580μ long: First article, 120 to 164μ; second, 155 to 160μ by 140μ broad; third, 112 to 140μ; fourth, 125 to 145μ, with 8 to 14 terminal stiff bristly hairs; all articles, especially the second, bear stiff bristly hairs, most of which are slightly pennate. Genital pore narrower than the capitulum, 128 to 204μ broad.

Female.—Attains 11 mm. long by 8.5 mm. broad. Capitulum attains 670μ broad. Mandibles 1.04 mm. long, digit 80μ; stem 352μ; swollen base, 598 by 320μ. Hypostome as in male. Palpi: First article, nearly square, 160μ long; second article, 196 by 128μ; third, 160 by 112μ; fourth, 160 by 96μ; 8 to 9 short, stiff terminal hairs on the fourth article; hairs on surface of all articles, especially the second. Genital pore broader than capitulum (960:670), between coxæ I and II.

Hexapod embryo measures 680 to 768μ in length, exclusive of capitulum, and about the same in breadth; the capitulum is slightly subterminal, but its appendage and a slight portion of the base extend out prominently beyond the anterior margin of the body. Dorsally and ventrally the cuticle is much wrinkled, the lines extending for the greater part transversely; in the middle of the back there is a circular to oval area without wrinkles. Dorsal and ventral surfaces, also the articles of legs and palpi, are provided with pennate hairs, the most prominent being a ventral row near posterior margin of body. Base of capitulum (ventral view), 192μ long by 208μ broad anteriorly, 160μ broad posteriorly. Hypostome 144μ long, distinctly composed of two halves closely united in median line, its tip provided ventrally with several transverse slightly irregular minute denticles; these are followed proximally by larger denticles arranged first in three, then in two longitudinal rows, the teeth of the lateral (marginal) row being strongest, seven in number, and extending to the base; inner row smaller, may also extend to the base. Mandibles 304 to 334μ long; digit 44μ, inner apophysis biden-

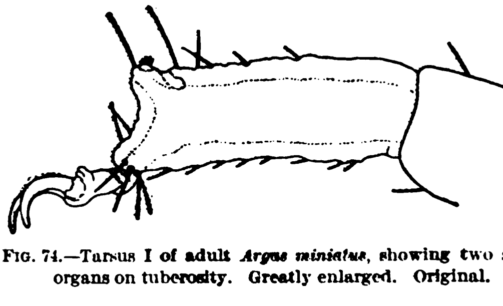
FIG. 74.—Tarsus I of adult *Argas miniatus*, showing two sense organs on tuberosity. Greatly enlarged. Original.

tate, with rather circular base, outer apophysis bidentate, middle apophysis very minute; narrow stem of mandibles 145μ long; swollen base, 145μ long by 72μ broad. Palpi 258μ long, fourth article longest (100μ) and provided with six or seven terminal hairs. Coxæ contiguous,[1] legs I and III being equally long, II slightly shorter; claws furnished with distinct pad.[2]

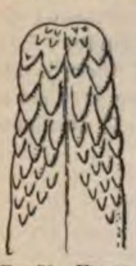

FIG. 76.—Hypostome of male *Argas miniatus*. After Neumann, 1896, p. 10, fig. 10.

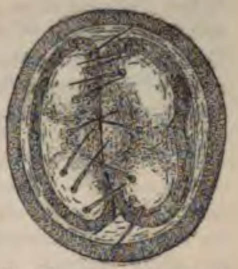

FIG. 75.—Anus of *Argas miniatus*. Greatly enlarged. Original.

This tick has been reported or sent to the Department of Agriculture a number of times from Texas and Florida, where it is claimed to do serious damage to chickens. So far as we know, it has been reported only once for cattle, Packard having found it among a number of specimens of *Boophilus annulatus* taken from cattle. We have seen one case from Florida in which a chicken was literally covered with the hexapod stage.

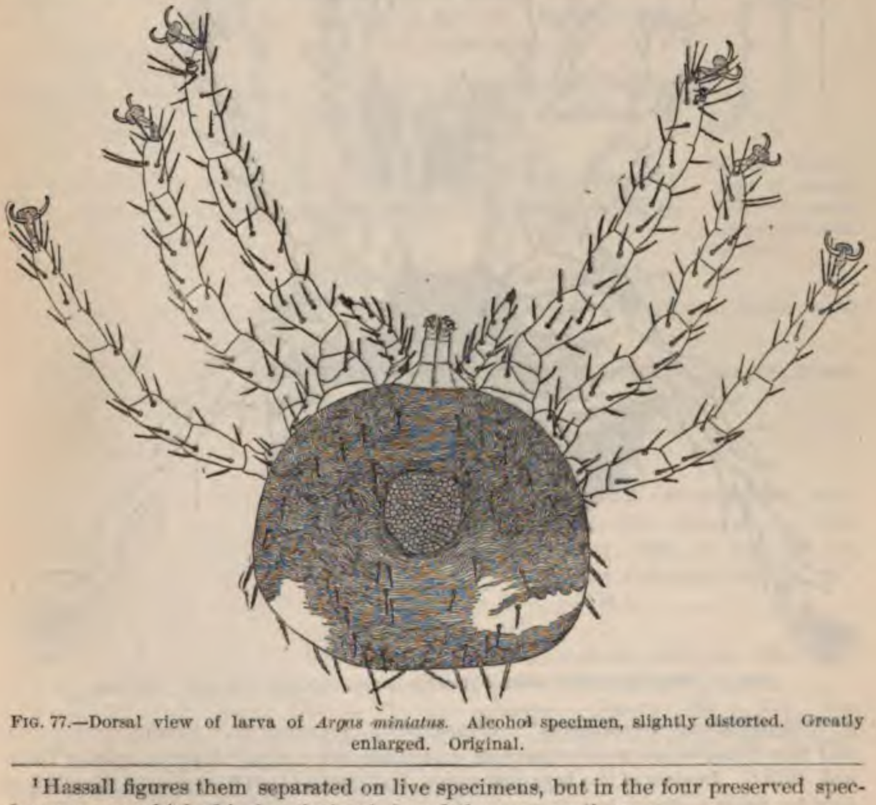

FIG. 77.—Dorsal view of larva of *Argas miniatus*. Alcohol specimen, slightly distorted. Greatly enlarged. Original.

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[1] Hassall figures them separated on live specimens, but in the four preserved specimens upon which this description is based they are contiguous.

[2] Hassall has figured this from live specimens as a disk with ventral concavity; in preserved specimens it is distinctly convex ventrally.

Regarding the technical name of this species an unfortunate confusion has arisen. When Packard proposed the name "*Argas americana*" in 1873, he overlooked the fact that Ercolani in 1859 had adopted the name "*Argas americanus* Latreille" for a form which is parasitic on the ears of horses in San Domingo. In 1871, Gamgee also referred to the same form as "*Argas americanus*." Furthermore, it appears that in 1804, *Amblyomma americanum* was placed in the genus *Rhynchoprion* by Hermann as "*Rhynchoprion americanum*." *Rhynchoprion*, however, is a synonym of *Argas*, and this combination would therefore invalidate the name "*Argas americana* Packard, 1873." In view of the facts just stated, Railliet changed the name of the chicken tick to *Argas radiatus*, but Neumann has recently reexamined the types of Koch's *A. miniatus* from French Guiana and pronounced them identical with this species. *A. Sanchezi* is also probably identical with the chicken tick.

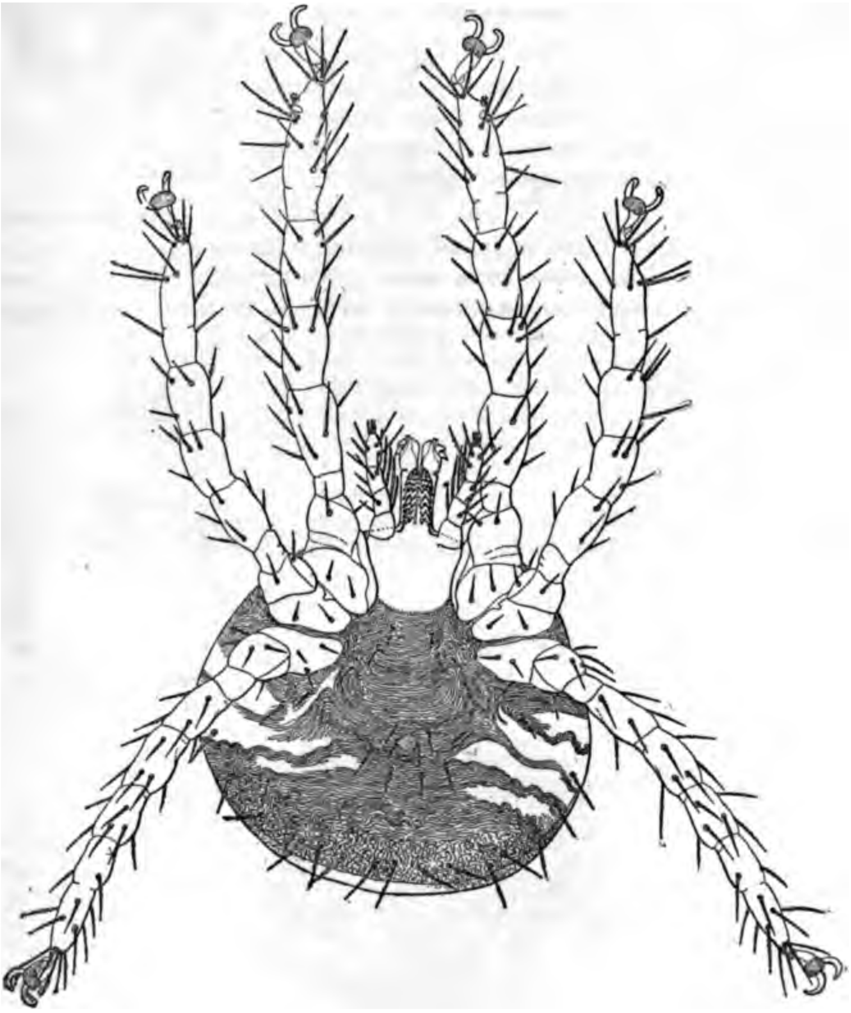

FIG. 78.—Ventral view of larva of *Argas miniatus*. Greatly enlarged. Original.

GENUS ORNITHODOROS[1] Koch, 1844.

GENERIC DIAGNOSIS.—*Argasidæ:* Body sometimes oval, lateral borders generally straight or almost straight and parallel, occasionally concave; anterior end more or less pointed, the sides diverging from here backward to the insertion of the II pair of legs; posterior end rounded. Hood recurved ventrally, where it is hollowed out to form a so-called "camerostome" with thick edge. Margins of body thick, with undifferentiated tegument. Tegument mammillated with hemispherical elevations of various designs; on the dorsal surface variable depressions; on the ventral surface more or less constant folds and grooves; two paired longitudinal projecting folds (coxal folds) near median border of coxæ, disappearing posterior of coxæ IV; a pair of similar folds (supercoxal folds) above and lateral of coxæ; one transverse preanal furrow; one transverse postanal furrow; one longitudinal anal groove extending from anus to postanal groove. Eyes present or absent.

TYPE SPECIES.—*O. Savignyi* (Audouin, 1827) KOCH, 1844.

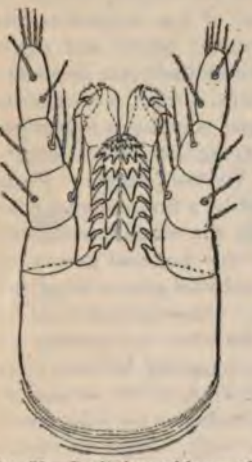

FIG. 79.—Capitulum of larva of *Argas miniatus.* Ventral view. Greatly enlarged. Original.

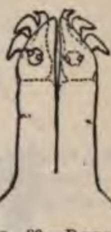

FIG. 80.—Dorsal view of mandibles of same. Greatly enlarged. Original.

Neumann cites ten species for this genus. The best-known forms are—

Ornithodoros Savignyi, an African form which attacks man and animals and is alleged to produce quite serious effects.

O. turicata, an American form (South America, Mexico, southern United States) which attacks hogs and man, with alleged occasional fatal results.

O. Megnini, the spinose ear tick which attacks cattle, horses, asses, dogs, sheep, and man.

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[1] SYNONYMY AND BIBLIOGRAPHY.

1844: *Ornithodoros* KOCH, 1844, p. 219.—IDEM, 1847, pp. 11-12.—FÜRSTENBERG, 1861, p. 208.—CANESTRINI, 1890, p. 531.—IDEM, 1892, p. 582.—TROUESSART, 1892, p. 47.—NEUMANN, 1896, pp. 3, 25-44.—LOUNSBURY, 1899, p. 240.—WARD, 1900a, pp. 196-198.—IDEM, 1900b, p. 437.—SALMON & STILES, 1901, pp. 407-414. [See also CANESTRINI & FANZAGO, 1877, p. 194.]

1877: *Argas* (*Ornithodoros*) in MURRAY, 1877, p. 183.

1878: "*Ornithodorus* Koch" of KARSCH, 1878, p. 321.—MARX, 1892, pp. 233, 234.—IDEM, 1895, p. 199.—OSBORN, 1896, p. 255.—MORGAN, 1899, p. 137.

1895: *Rhynchoprium* MARX, 1895, p. 199; type, *spinosum.*—OSBORN, 1896, p. 255. [See also NEUMANN, 1896, p. 42.] [Not to be confused with *Rhynchoprion* HERMANN, 1804, arachnoid; OKEN, 1814, dipteron.]

1899: "*Ornithodorous* Koch" of MORGAN, 1899, p. 136.

The Spinose Ear Tick (*Ornithodoros Megnini*).[1]

(Figures 65-67, 82-108.)

Specific diagnosis.—*Ornithodoros: Adult.*—Body phial-shaped; slightly attenuated anteriorly, broadest at legs II, slightly constricted near legs IV, broadly rounded posteriorly; color brown to violet or black. On the surface, symmetrical depressions, one arciform, longitudinal, from each side of the projection corresponding to the capitulum; lateral and slightly anterior of this, an infundibuliform depression; in back, along the lateral border, a longitudinal groove of variable length, sometimes interrupted; a median groove occupying the greater length of the posterior half. Ventral surface: Preanal groove absent, replaced by a first postanal groove at a tangent to the anal slit, straight and joining the coxal groove; the true postanal groove near posterior border; a broad anal groove terminating at this postanal groove. Subcoxal and coxal folds broad, well marked, the latter not passing coxæ II, and the coxal groove passing between coxæ I and II, extending backward to the second postanal groove and disappearing on the sides near the posterior angle of the body. Stigmata circular, 250 μ in diameter, stigmal pore semilunar. Anal valve broader than long (150 to 200 μ by 200 to 250 μ), each lip provided with short hairs. Eyes absent. Tegument slightly rough (shagreened), forming an irregular mosaic, strewn with numerous fine, short hairs. Reticulate fossettes occupy the ventral and dorsal depressions; others scattered here and there.

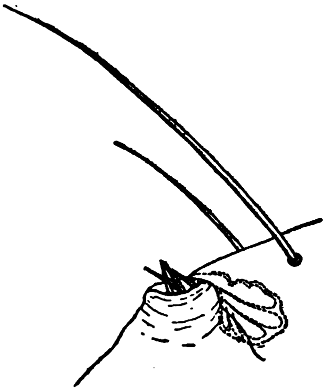

Fig. 81.—Two sense organs on tarsus I of embryo of *Argas miniatus*. Greatly enlarged. Original.

On the ventral surface between the two postanal grooves, extremely small and hard spines. Capitulum very small and short; 150 μ from base of palpi to extremity of hypostome. Maxillæ slender, 490 μ long, digit 75 μ, stalk slightly and insensibly swollen proximally. Internal apophysis of digit thick, provided with four teeth, two terminal nearly perpendicular to each other, and two intermediate, smaller; external apophysis with superior tooth slightly salient, inferior tooth large, bent backward; median tooth well developed. Hypostome blade-shaped, broad at the base, rounded at the extremity, unarmed.[2] Palpi thick, 300 μ long (90 μ, 85 μ, 65 μ, 60 μ, from first to fourth article), with articles relatively broad and short, the second

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[1] Synonymy and Bibliography.

1883: *Argas Megnini* Dugès, 1883, pp. 196, 197.—Mégnin, 1885, pp. 466, 472–475, pl. xxi, figs. 1-8.—Neumann, 1888, p. 96.—Idem, 1892a, p. 101.—Idem, 1892b, p. 105.—Railliet, 1893, p. 718.—Dolly, 1894, p. 980. [See also Neumann, 1896, p. 42, as syn. of *Ornithodoros Megnini*.]

1893: "*Argas americana* Packard" of Townsend, 1893, pp. 50–52.

1895: *Rhynchoprium spinosum* Marx, 1895, p. 199, pl. ii, figs. 1-1i.—Osborn, 1896, pp. 255, 256, pl. iii, figs. 1-1i. [See also Neumann, 1896, p. 42, and Stiles & Hassall, 1891, p. 1, as syn. of *Ornithodoros Megnini*.]

1896: *Ornithodoros Megnini* (Dugès) Neumann, 1896, pp. 42–44, figs. 36 a-b.—Ward, 1900a, p. 199, fig. 3.—Stiles & Hassall, 1901, pp. 1, 2.—Salmon & Stiles, 1901, pp. 408–414, figs. 65–67, 82–108.

[2] Mégnin describes and figures teeth in five transverse rows, of which the first on each half comprises only one tooth, and the last four; none of Neumann's or our preparations corresponded to this description.

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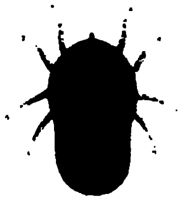

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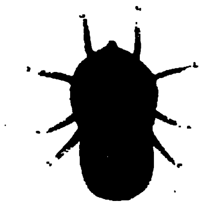

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FIGS. 82, 86, 90. DORSAL VIEWS OF THE SPINOSE EAR TICK (ORNITHODOROS MEGNINI). NATURAL SIZE. ORIGINAL.

FIGS. 83, 87, 91. THE SAME. X2. ORIGINAL.

FIGS. 84, 88, 92. VENTRAL VIEWS OF SAME SPECIMENS. NATURAL SIZE. ORIGINAL.

FIGS. 85, 89, 93. THE SAME. X2. ORIGINAL.

110 μ broad; on dorsal surface of the articles, especially of the first and at the dorsal base of the capitulum, in back of the insertion of the palpi, numerous pennate hairs. Two ventral hairs at the base of the capitulum. Legs thinner and a little shorter than in the nymph; coxæ as in the other members of the genus; prominent tuberosity on dorsal surface of the tarsi.

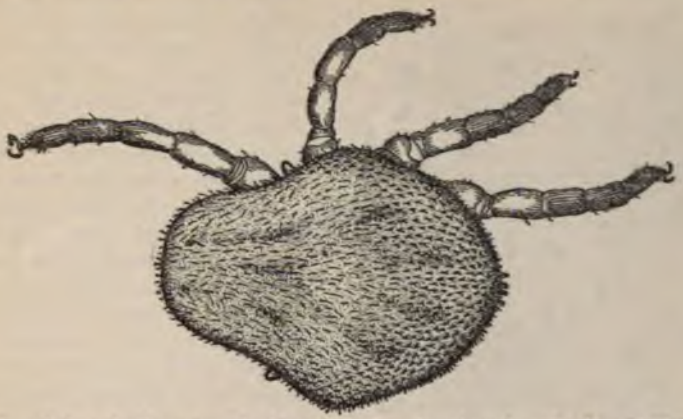

FIG. 94.—Dorsal view of spinose nymph of ear tick. Greatly enlarged. After Marx, 1895, Pl. II, fig. 1.

Dimensions.—Females, 5 to 6 mm. by 3 to 4 mm.; males somewhat smaller.

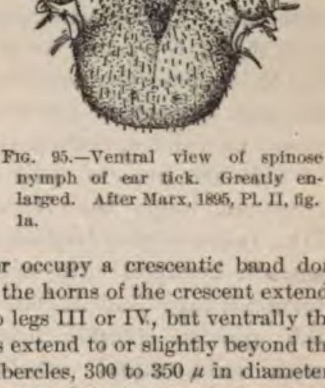

FIG. 95.—Ventral view of spinose nymph of ear tick. Greatly enlarged. After Marx, 1895, Pl. II, fig. 1a.

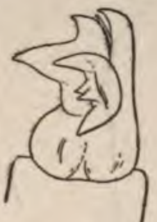

FIG. 96.—Digit of mandible of nymph. After Neumann, 1896, p. 43, fig. 36a.

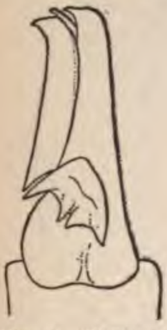

FIG. 97.—Digit of mandible of adult. After Neumann, 1896, p. 43, fig. 36b.

Nymph.—Body somewhat longer than broad, greatest breadth at about III pair of legs, anterior of this the outline is bluntly rounded; posteriorly, suddenly contracted at IV pair of legs; may attain 3 to 8 mm. in length and 2 to 5.5 mm. in breadth. Tegument thickly beset with spines anteriorly, and bristly hairs posteriorly; the former occupy a crescentic band dorsally, the horns of the crescent extending to legs III or IV, but ventrally the spines extend to or slightly beyond the anus. Stigmata on salient tubercles, 300 to 350 μ in diameter. Anus very small, slightly broader (110 to 120 μ) than long. Capitulum subterminal in young, inferior in older individuals, elongate, base as long as palpi; about 375 μ from base of palpi to tip of hypostome. Mandibles 760 μ, digit 85 μ, base scarcely swollen posteriorly; internal apophysis of digit strong, with four teeth, two external and terminal, two small and intermediate; external apophysis with long, strong poster-posterior teeth; median apophysis normal. Hypostome lanceolate, each half with four rows of seven to nine strong alternating teeth, the teeth of the median row on each half on same transverse planes. Palpi thick, 455 μ long (140 μ, 125 μ, 110 μ, 180 μ, from first to fourth article); second article 110 μ broad; hairs not very numerous on last three articles, six to eight short terminal bristles. Legs long and strong; coxæ very short, but broad, almost marginal; other articles cylindrical, relatively short compared with their diameter; ventro-terminal portion of tarsi elongate, claws strong, pulvillum absent.

Hexapod larva.—The hexapod larva is elongate oval, with long terminal capitulum, measuring 0.61 mm. from tip of hypostome to posterior extremity. The tegument is finely striated, and pierced with symmetrically arranged pores, from which bristle-like hairs issue. The palpi and hypostome are of practically equal length; hypostome with two rows of denticles on each half; palpi, first article short, second and third long and equal, fourth short. Between coxæ I and II, and II and III, are found minute spiracle-like[1] structures in the cuticle. On the claws is found a small pulvillum-like pad.

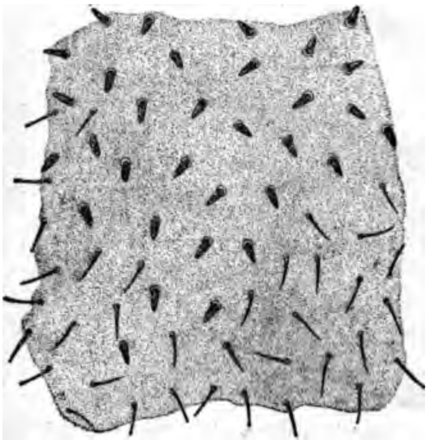

FIG. 98.—Portion of skin, showing spines and hairs. Greatly enlarged. Original.

Some of our specimens of this species show a pupa-like stage. They are about 4 mm. long by about 2 mm. broad, rounded white pyriform structures with one end elongate. Closer examination shows the outer covering to be a smooth, cast skin; the cast hypostome has two rows of denticles; three pairs of legs are present, pair I larger and longer than II and III. Inside of this distended smooth hexapod skin with terminal capitulum is found the spinose octopod form with subterminal capitulum, and with well-developed claws on the tarsi, and four rows of denticles on each half of the hypostome.

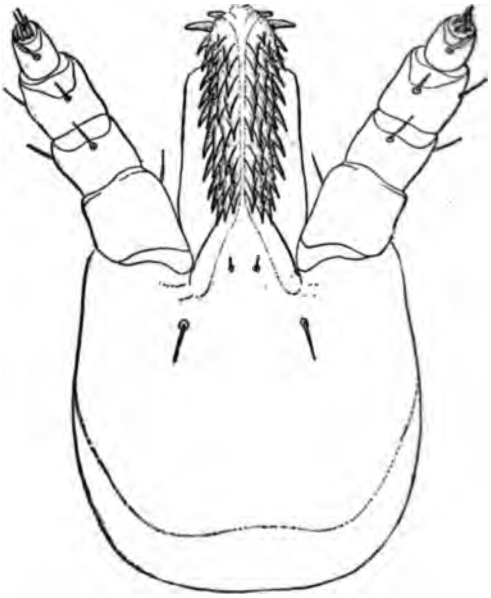

FIG. 99.—Ventral view of capitulum of same. Original. Greatly enlarged.

We have not seen this stage alive, but from the general structure it is apparent that in changing from the hexapod to the octopod stage *O. Megnini* passes a resting pupa-like stage. This is by no means surprising, since the differences between the hexapod and the octopod stages of the Argasidæ are far greater than those between the corresponding stages of the Ixodidæ. This is apparently the stage which Townsend (1893) interpreted as an egg.

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[1] Whether these structures are actually stigmata and pulvilli remains to be determined when fresh material can be obtained.

The specimens in question were taken on post-mortem examination from the ear of cattle in San Dimas, Cal., by Mr. M. L. Eckels, and sent with other stages of the same tick to this laboratory for determination.

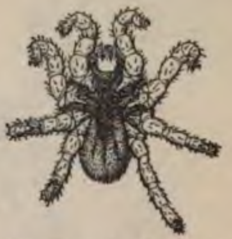

FIG. 100.—Ear tick after shedding the nymph skin. Greatly enlarged. Original.

This tick is remarkable for the difference in appearance between the young spiney stage and the adult form, a difference that is so great that the two stages have been described as belonging to different species.

The ear tick has been reported to this Bureau a number of times, notably from Texas, New Mexico, California, Kansas, and Nebraska. It was originally described from Mexico by Dugès, who gave the following account of it:

Argas Megnini Alf. Dug.[1]—This epizoon, very abundant in the State of Guanajuato, is found on the horse, the ass, and the ox, principally in the ears, and is spread frequently to other animals, in particular to man, for I have often removed it from the ear passage of children, and even of adults.

The body of the Garrapata, wider anteriorly than posteriorly, in the shape of a guitar, is less depressed than that of the Turicata. It is covered with little horny spines, the color of mahogany, surrounded by a border at the base; the general color is lead color, with legs of deep yellow. The male, very small compared with the female, and yellowish when it is fasting, has large legs comparatively, the largest being those of the pair IV. The legs are more robust than those of the Turicata, separated from each other, and it is difficult to distinguish the posterior ones. There are two little spines under the last article. The mouth pieces extrude from a circular fold; the maxillæ have at the extremity two bidentate laminæ, and the hypostome is provided with teeth, directed posteriorly and much sharper in the male than in the female.

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[1] *Argas Megnini* Alf. Dug.—Este epzoario, abundantísimo en el Estado de Guanajuato, se halla sobre el caballo, el asno y el buey, principalmente dentro de las orejas, y se pega con frecuencia á otros animales, en particular al hombre, pués no pocas veces lo he extirpado del conducto auricular de niños y aun de adultos.

El cuerpo de la garrapata, más ancho hácia adelante que hácia atrás, en forma de guitarra (panduriforme), es ménos deprimido que el de la Turicata; está cubierto de pequeñas espinas córneas (v. fig. 1), color de coaba, circundados por un rodete en la base (fig. 4); el color general es aplomado, con las patas de un aleonado bajo. El macho (fig. 3), muy chico respecto á la hembra, y amarilloso cuando está en ayunas, tiene las patas más largas respectivamente, siendo más grandes las del cuarto par. Las patas (fig. 5) son más robustas que de la Turicata, apartadas una de otra (fig. 2), y con dificultad se distinguen las ancas; hay dos espinitas debajo del último artículo. Las piezas bucales salen de un repulgo circular; las maxilas tienen en la extremidad dos laminas bidentadas (fig. 8, a) y la lengüeta (fig. 8, b) está provista de dientes dirigidos hácia atrás y más agudas en el macho que en la hembra.

Como se ve por esta breve descripción, puramente diferencial, no se pueden confundir las Turicatas con las Garrapatas. Parecen estas últimas ménos nocivas; á lo ménos es más fácil hacerles soltar la presa, é impedir que dejen su rostro en la herida; muchas veces basta el aceite para obligarlas á desprenderse.

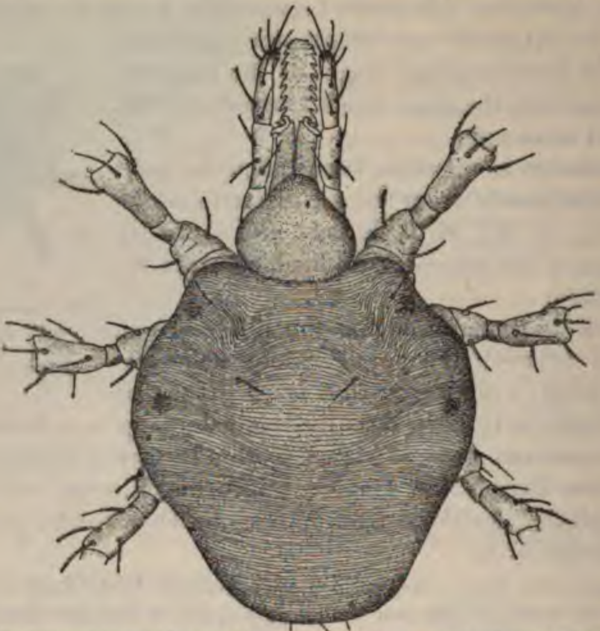

FIG. 101.—Dorsal view of hexapod larva of ear tick. Greatly enlarged. Original.

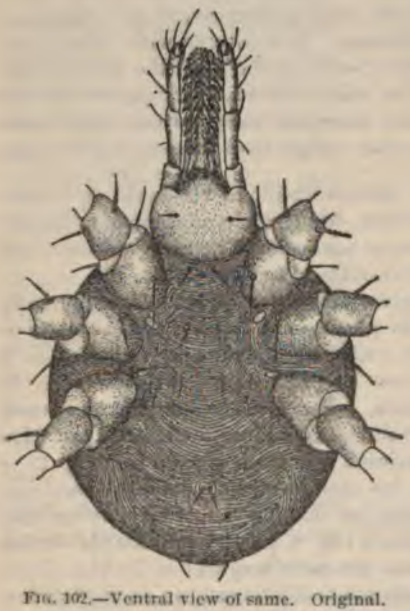

FIG. 102.—Ventral view of same. Original.

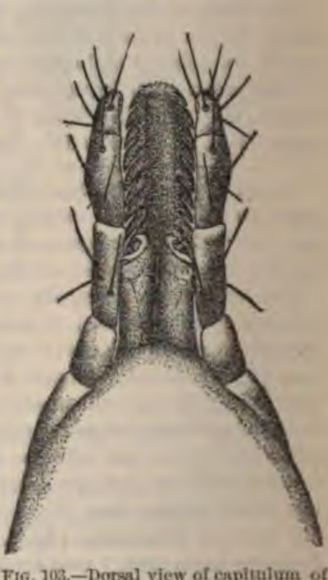

FIG. 103.—Dorsal view of capitulum of same. Greatly enlarged. Original.

As is seen from this brief, purely differential description, it is not possible to confuse the Turicatas with the Garrapatas. It seems that these latter are less noxious; at least it is easier to make them loose their hold, and to prevent their leaving the capitulum in the wound; frequently oil is sufficient to make them drop off.

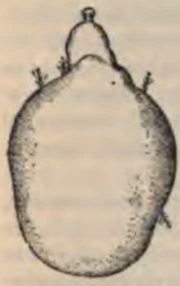

FIG. 106.—Dorsal view of resting stage between hexapod and octopod forms. Greatly enlarged. Original.

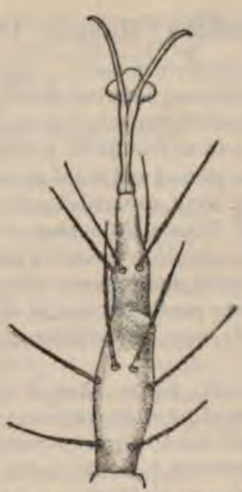

FIG. 105.—Dorsal view of same. Original.

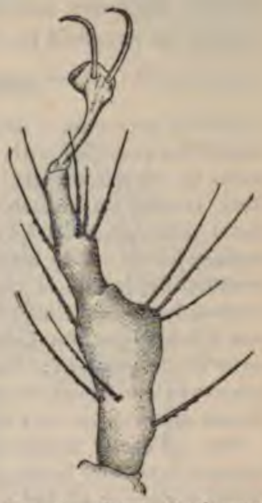

FIG. 104.—Tarsus I of same side view. Original.

Neumann examined a number of specimens collected in Mexico by Dugès, basing a detailed description upon them. This description seems to agree in essential characters with the forms we find in the United States. Neumann calls attention to the fact that the nymph is better armed than the adult and may grow to be as large. He states that he would hesitate to consider these two forms as belonging to the same species had he not found a cast nymph skin around a female. We have repeatedly followed this transformation on specimens sent to us, and can confirm beyond question the statement that the nymph and the adult are very dissimilar.

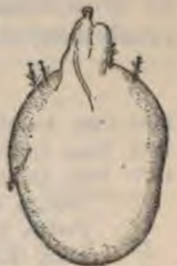

FIG. 107.—Ventral view of same. Greatly enlarged. Original.

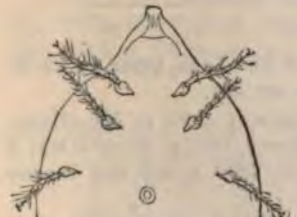

FIG. 108.—Outline of another specimen of same. Greatly enlarged. Original.

Judging from letters received by this Bureau, the ear tick is accused of causing a variety of troubles. Some correspondents report sickness and even death among cattle as having been caused by the parasite, while others are not inclined to attach so much importance to its presence.

Owing to their position in the ear, it is not possible to use any very drastic measures against them, but, as a rule, if any bland oil, such as linseed or olive oil, is poured into the ear, the ticks will soon vacate; they are not killed by this treatment, hence every tick caught should be crushed in order to prevent increase.

Family Ixodidæ[1] Murray, 1877.

Family diagnosis.—*Ixodoidea:* Scutum present. Capitulum terminal. Digit of mandibles provided with two apophyses; internal apophysis generally short, terminated by one to four equal or unequal teeth; external apophysis elongate, parallel to digit, bearing on its free border two to five teeth, which increases in size from the distal to the proximal. Palpi free, second and third articles valvate on their median surface; fourth article very short in adult, as tactile appendage, situated in an inferoterminal depression of the third. Legs a little unequal, pair II shortest, pair IV longest; femur and tibia presenting pseudo-articulation near proximal end, except in pair I, where the pseudo-articulation is distal; tarsus with pulvillum. Stigmata posterior of the coxæ IV. Genital pore median at height of coxæ I to III; two sexual grooves extend from here posteriorly, more or less divergent, toward posterior margin. Sexual dimorphism very marked.

Male.—Usually smaller than female, flatter, often of less regularly oval contour, anterior extremity being much straighter than posterior; dorsal shield covers entire dorsal surface or all but a marginal band; posterior margin ordinarily divided into eleven quadrangular festoons, distributed between dorsal extremity of the two stigmata, and often extending under the ventral surface. These represent in some cases marginal shields, the number and form of which are often variable.

Female.—At first flat, later may become very thick, dorsal shield confined to anterior part of animal, remains comparatively small. Capitulum with two symmetrical porose areas, not found in larvæ, nymphs, or males.

Type genus.—*Ixodes* Latreille, 1796.

Most of the ticks described to date belong to this family, which may be divided into two subgroups, ranked by some authors as "families," by other authors as "tribes." The most natural course to follow is to call them subfamilies, under the names Ixodinæ and Rhipicephalinæ.

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[1] Synonymy and Bibliography.

1834: Fam. *Ixodei* (French *Ixodès*) Dugès, 1834a, pp. 14, 19–20.—Idem, 1834c, pp. 33–35.

1859: Fam. *Ixodidès* Gervais & van Beneden, 1859, pp. 460, 461.

1877: Fam. *Ixodidæ* Murray, 1877, pp. 185–204.—Canestrini, 1890, p. 530.—Idem, 1892, p. 581.—Idem, 1897, pp. 468, 469.—Trouessart, 1892, p. 22.—Salmon & Stiles, 1901, pp. 414–478. [See also Canestrini, 1890, p. 482, and Trouessart, 1891, pp. 295, 297, 302.]

1877: Fam. *Ixodini* Canestrini & Fanzago, 1877, pp. 178–192.—Canestrini, 1890, pp. 475–529. [See also Trouessart, 1891, p. 307.]

1880: Tribe *Ixodides* Mégnin, 1880, pp. 120–132.

1885: Subfam. *Ixodidæ* Berlese, 1885, p. 131.

1886: Tribe *Ixodinès* Railliet, 1886, pp. 495–499.—Neumann, 1888, pp. 89–95.—Idem, 1892a, pp. 93–100.

1892: Subfam. *Ixodinæ* Trouessart, 1892, pp. 38, 47.—Railliet, 1893, pp. 704–714.—Neumann, 1896, p. 2.—Idem, 1897, pp. 324–420.—Idem, 1899, pp. 107–294.—Ward, 1900a, pp. 196, 199–205.—Idem, 1900b, pp. 435–437. [See also Trouessart, 1891, p. 307; misquotation for *Ixodidæ*.]

1892: Tribe *Ixodinæ* Neumann, 1892b, pp. 96–104.

1892: Group *Antistomata* Marx, 1892, pp. 234–236.

Subfamily Rhipicephalinæ[1] Salmon & Stiles, 1901.

Subfamily diagnosis.—*Ixodidæ:* Palpi short, more or less conical, but usually longer than the hypostome.

Type genus.—*Rhipicephalus.*

This subfamily contains the genera *Rhipicephalus*, *Boophilus*, *Hæmaphysalis*, and *Dermacentor*. (For analytical key, see p. 385.)

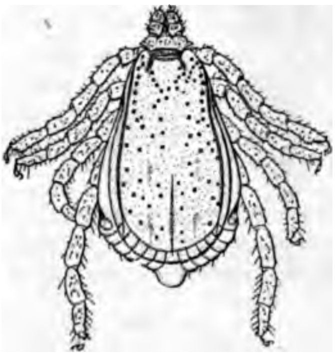

Fig. 109.—Dorsal view of an Italian male *Rhipicephalus sanguineus.* Greatly enlarged. Original.

Genus Rhipicephalus[2] Koch, 1844.

Generic diagnosis.—*Rhipicephalinæ:* Eyes distinct; base of capitulum broader than long, hexagonal on dorsal surface, forming at each side a projecting angle. Palpi short, broad; third article prolonged on its dorsal surface by a short retrograde point; first article by an internal (median) lobe, occasionally not distinct, and slightly retrograde. Coxæ I with two generally large teeth. Stigmata in form of a comma, with short tail in the female, long tail in the male.

Male with two pairs of anal shields (clypei): (1) One pair of large adanal shields placed at each side of the anus, triangular or occasionally rectangular; (2) one pair of smaller shields lateral of these.

Type species.—*R. sanguineus* (Latreille).

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[1] Synonymy and Bibliography.

1844: Fam. *Rhipistomiden* Koch, 1844, pp. 234–239.—Idem, 1847, p. 24–27.
1861: Fam. *Rhipistomides* Fürstenberg, 1861, p. 208.
1890: *Conipalpi* Canestrini, 1890, p. 491. [See also Neumann, 1897, p. 325.]
1892: Fam. *Rhipistomidæ* Marx, 1892, pp. 235, 236. [See also Canestrini, 1890, p. 482.—Trouessart, 1891, p. 298.]
1897: Tribe *Rhipicephalæ* Neumann, 1897, pp. 325–420.
1901: Subfam. *Rhipicephalinæ* Salmon & Stiles, 1901, pp. 415–458.

[2] Synonymy and Bibliography.

1844: *Rhipicephalus* Koch, 1844, pp. 238, 239.—Idem, 1847, pp. 26, 27.—Fürstenberg, 1861, p. 208.—Murray, 1877, pp. 187, 200.—Canestrini & Fanzago, 1877, pp. 179, 186, 190–192.—Canestrini, 1890, pp. 479, 483, 484, 487, 489, 490, 491, 492, 493, 513–519.—Idem, 1892, p. 581.—Trouessart, 1892, p. 47.—Railliet, 1893, p. 712.—Marx, 1892, pp. 233, 235, 236.—Neumann, 1897, pp. 325, 326, 384–418.—Morgan, 1899, pp. 138, 139.—Ward, 1900a, p. 201.—Salmon & Stiles, 1901, pp. 415–419.
1889: *Phauloixodes* Berlese, 1889, fasc. lv, Nos. 7–8; type, *rufus*. [See also Neumann, 1897, pp. 384, 385, as syn. of *Rhipicephalus*.]
1889: *Phaulixodes* Berlese, 1889, fasc. lv, No. 8, Taf. (misprint for *Phauloixodes*).—Canestrini, 1890, pp. 485, 487, 488, 490, 491, 492, 511.—Neumann, 1897, p. 420.
1892: "*Phautoixodes* Berlese" of Marx, 1892, p. 236.—Morgan, 1899, p. 139.
1899: "*Rhicephalus*" in Fuller, 1899, p. 392 (misprint for *Rhipicephalus*).

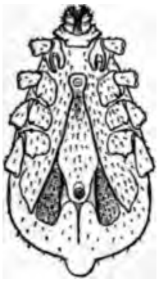

Fig. 110.—Ventral view of *Rhipicephalus sanguineus.*

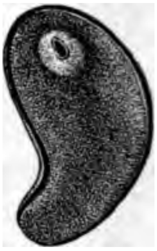

Fig. 111.—Stigmen of same. Greatly enlarged. Original.

There is some difference of opinion regarding the genus to which the Texas fever tick belongs. While it was originally placed in the genus *Ixodes* by both Say and Riley, Curtice proposed for it a new genus, *Boophilus*, and this name has been very generally adopted by American authors and even by the press. Its validity is, however, disputed. Undoubtedly the Texas fever tick does not belong in *Ixodes*, and the question is whether it should be placed in *Rhipicephalus* or be made the basis of a distinct genus, *Boophilus*. It must be admitted that *Boophilus* is by no means so clearly defined from *Rhipicephalus* as the latter is from *Dermacentor*, *Hæmaphysalis*, or *Ixodes*. On the other hand, it is to a certain extent different from the average *Rhipicephalus*. Neumann, who has examined more different species of ticks than any other author, and to whose opinion, therefore, great weight should be attached, unhesitatingly suppresses the genus *Boophilus*, not giving to it even subgeneric rank. Ward, on the other hand, inclines to look upon *Boophilus* as of generic rank, and the late Dr. Marx (1892) was of the same opinion. Our own view has been for some years that *Boophilus* should be given at least subgeneric rank under *Rhipicephalus*.

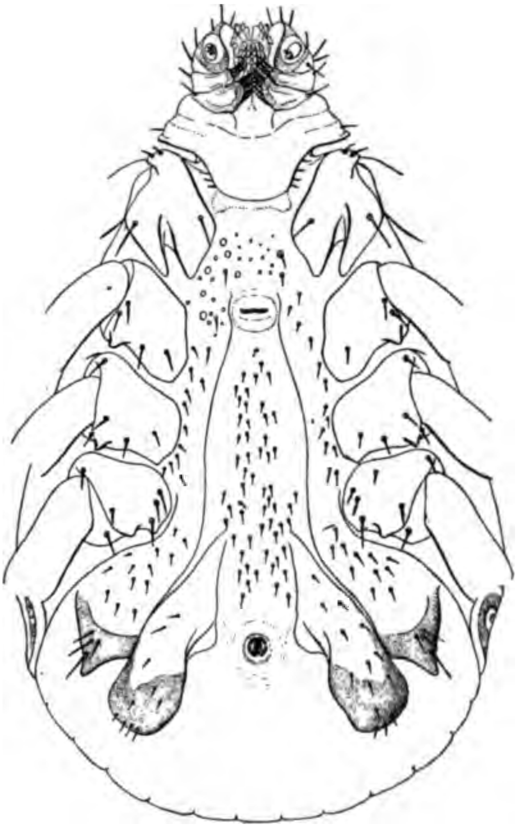

Fig. 112.—Ventral outline of an undetermined *Rhipicephalus* from a dog. Porto Rico. Original.

The point at issue is of both theoretical and practical importance. Under existing circumstances, we consider it better in the present paper to hold to the name *Boophilus*, recognizing this as a distinct genus. We are led to this conclusion, not only because of the fact that the genus *Boophilus* is not entirely unjustified, hence a change to *Rhipicephalus* at present might be only temporary, but from a practical standpoint, we prefer not to change a technical name which has become almost vernacular, unless the necessity for such change is clearly indicated. From the fact that some authors consider *Boophilus* as entirely distinct from *Rhipicephalus*, while others consider the two genera congeneric, it is evident that the question is not definitely settled. Of the two opinions the one here temporarily adopted has the advantage of coinciding with the more generally used name, and in matters of public hygiene, where others besides zoologists are concerned, it is necessary to take this into consideration, unless popular vernacular is directly contradicted by technical facts.

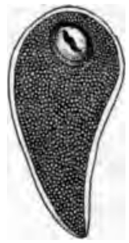

FIG. 113.—Stigmen of same. Greatly enlarged. Original.

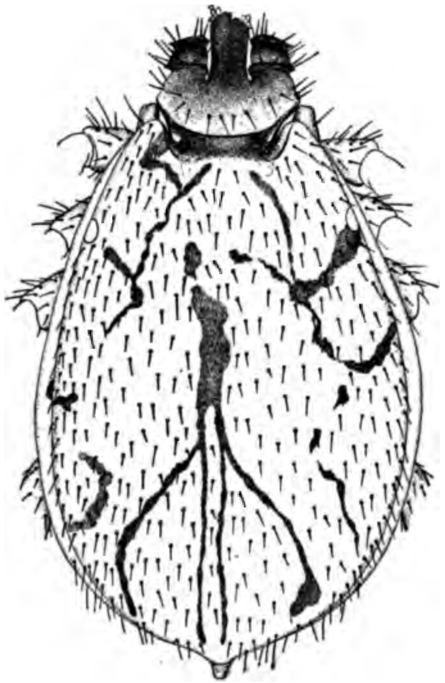

FIG. 140.—Dorsal view of male *Boophilus australis*, from Porto Rico, after several generations on cattle at Bethesda, Md. Greatly enlarged. Original.

Marx (1892) states that "*Rhipicephalus* is represented in North America by a beautiful species from California, and one from Cape Disappointment, Washington." After the elimination of the Texas fever tick, however, we are not personally acquainted with any North American species of *Rhipicephalus*. *R. sanguineus* is reported by Neumann for Panama, and *R. bursa americanus* for Jamaica. We have specimens of an undetermined *Rhipicephalus* from Porto Rico.

The following table of species is given by Neumann:

KEY TO THE SPECIES OF THE GENUS RHIPICEPHALUS.[1]

[For forms (*Boophilus*) reported in the United States, follow Roman type.]

Females	1
Males	13
Nymphs (*Phaulixodes*)	23

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[1] This key does not include the following species: *R. javanensis*, *R. flavus*, *R. bhamensis*, *R. hæmaphysaloides*, *R. ruber*, *R. Linnei*.

A.—*Female.*

1. *Palpi flat dorsally, sides straight or convex* 2
Palpi short, thick, angular, second and third articles each drawn out laterally to a sharp point (*Boophilus*) 12
2. *Scutum brown or brownish* 3
Scutum white (Zanzibar) .... *R. pulchellus.*
3. *Abdomen of uniform color* 4
Abdomen with white lines and points (Zanzibar) .... *R. perpulcher.*
4. *Scutum elongate oval* 5
Scutum short oval or as broad as long 8
5. *Scutum decidedly emarginate in front* 6
Scutum slightly emarginate in front (Zanzibar) .... *R. brevicollis.*
6. *Scutum with unequal* (*large and small*) *punctations* (Europe, Asia, Africa, Australia, Philippines, Central America) .... *R. sanguineus.*
Scutum with equal punctations 7
7. *Punctations linearly arranged, few in number* (Sumatra) .... *R. paulopunctatus.*
Punctations numerous (Africa) .... *R. punctatissimus.*
8. *Anal valve not bordered with white* 9
Anal valve bordered with white (Egypt) .... *D. rutilus.*
9. *Scutum with distinct punctations* 10
Scutum rough (*shagreened*) 11
10. *Punctations equal, close together* (Europe, Africa, West Indies) .... *R. bursa.*
Punctations unequal, separated (Africa) .... *R. simus.*
11. *Scutum not rough on margins; eyes light* (South Africa) .... *R. capensis.*
Scutum rough (*shagreened*) *on entire surface; eyes dark* (South Africa) .. *R. Evertsi.*
12. Scutum elongate, sides convergent back of the eyes (see p. 420) .. *R. annulatus.*
Scutum oval, sides not convergent back of the eyes (Africa) (see p. 433). *R. decoloratus.*

B.—Male.

13. *Palpi flat, sides straight or convex* 14
Palpi short, thick, angular; second and third joints each drawn out laterally into a sharp point (see *Boophilus*, p. 419) .... *R. annulatus.*
14. *Scutum of uniform color* 15
Scutum black and white (Zanzibar) .... *R. pulchellus.*
15. *Marginal groove of shield single* 16
Marginal groove of shield double (China) .... *R. carinatus.*
16. *Scutum with numerous punctations* 17
Scutum with few large punctations linearly arranged 22
17. *Punctations unequal* (*large and small*) 18
Punctations equal or nearly so 19
18. *Punctations distributed regularly* (Europe, Asia, Africa, Australia, Central America) .... *R. sanguineus.*
Punctations distributed irregularly (Africa) .... *R. punctatissimus.*
19. *Punctations separated* (*distant*) 20
Punctations contiguous, making scutum rough (*shagreened*) 21
20. *Punctations fine, covering entire surface* (Europe, Africa, West Indies)... *R. bursa.*
Punctations deep, absent from margin and marginal shields (Nubia) .. *R. compositus.*
21. *Postero-marginal festoons with white border* (South Africa) .... *R. capensis.*
Postero-marginal festoons of uniform color, only slightly distinct (South Africa) .... *R. Evertsi.*
22. *Scutum* (*of young specimens*) *cover entire dorsal surface* (Africa) .... *R. simus.*
Scutum (*of young specimens*) *absent from the margin* (Sumatra). *R. paulopunctatus.*

C.—Phaulixodes.

23. *Scutum longer than broad, with nearly straight sides* (see *R. sanguineus*)..... *rufus.*
Scutum longer than broad, sides curved (Algeria).......................... *plumbeus.*
Scutum as broad as long, sides slightly curved (Sumatra).............. *intermedius.*

GENUS BOOPHILUS[1] Curtice, 1891.

GENERIC DIAGNOSIS.—*Rhipicephalinæ*: Eyes present, often indistinct; base of capitulum broader than long, wider than combined width of palpi and haustellum, hexagonal on dorsal surface, forming at each side a projecting angle. Palpi short, broad; second and third articles nearly equal, and widest about the middle, where they are drawn out laterally into a sharp angle. Posterior margin of coxæ I bidentate, though often indistinctly. Stigmal plate round to oval. Male with two pairs of anal clypei.

TYPE SPECIES.—*Boophilus annulatus* (Say).

It can not be definitely stated at present how many species of *Boophilus* should be recognized. For North America only one form is described, *B. annulatus*, commonly known as *B. bovis*. Another form, *B. australis*, is found in Australia, India, South America, Cuba, and Porto Rico. A third form, *B. decoloratus*, is described from South Africa. It has been definitely established by Smith, Kilbourne, Schroeder, and others that *B. annulatus* is the transmitter of Texas fever in North America. *B. australis* has been shown to transmit the same disease in Australia, and Schroeder has transmitted Texas fever by means of Porto Rican ticks, which we look upon as identical with *B. australis*. Fuller believes that *B. decoloratus* acts as the transmitter of the fever in South Africa.

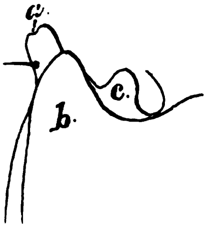

FIG. 141.—Antero-lateral corner, showing (*a*) projection of coxa 1, (*b*) antero-dorso-lateral, and (*c*) antero-ventro-submedian projection of scutum.

Other species have been described for other countries, but it is practically impossible at present to give a reliable opinion as to whether these forms represent true species or geographical varieties or whether they are identical with the above-named species.

From a practical standpoint of quarantine, however, the difficulties are not so great as they are from a strictly zoological point of view; for since it has been established that the North American, Porto Rican, and Australian forms all transmit Texas fever, and since, further, this disease also occurs elsewhere, as in South America, South Africa, etc., it will be necessary to look upon any form corresponding to *Boophilus* as potentially infectious.

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[1] SYNONYMY AND BIBLIOGRAPHY.

1891: *Boophilus* CURTICE, 1891a, pp. 313–319; type, *Ixodes bovis=annulatus.*—IDEM, 1891b, p. 685.—IDEM, 1892c, pp. 237–252, pls. I–II.—MARX, 1892, pp. 235, 236.—OSBORN, 1896, p. 257.—MORGAN, 1899, pp. 138, 139.—WARD, 1900a, p. 202.—STILES & HASSALL, 1901, pp. 2–4.—SALMON & STILES, 1901, pp. 419–446. [See also NEUMANN, 1897, p. 384, as syn. of *Rhipicephalus.*]

1898: "*Boophylis* Curtice" of NILES, 1898b, p. 25 (misprint for *Boophilus*).

The following key will serve to determine the various forms which come into consideration in connection with this genus:

KEY TO THE SPECIES OF THE GENUS BOOPHILUS.

[For forms reported in the United States, follow Roman type.]

1. *Fiery red spot anteriorly in middle field of female; male without a tail; number of rows of denticles unknown. Uncertain West Indian species*................ *Hæmaphysalis rosea*, p. 445

   No such spot reported for female; male with or without tail; 6 to 10 rows of denticles on hypostome.................................. 2

2. *Hypostome with 6 rows of denticles*.................................. 3

   Hypostome with 8 rows of denticles.................................. 4

   Hypostome with 10 rows of denticles; male with distinct horny tail. Type locality (Japan) ....*Rhipicephalus caudatus*, p. 437

3. *Male with distinct horny tail. The Blue Tick*, South Africa....*B. decoloratus*, p. 433

   Male unknown. A doubtful South American form. Type locality, Buenos Aires, p. 445

4. *Male with distinct horny tail* (Australia, India, Venezuela, Cuba, and Porto Rico) ....*B. australis*, p. 427

   Male without horny tail.................................. 5

5. North American form (porose areas of female not united in median line) ....*Boophilus annulatus*, p. 420

   North African form ....*Ixodes Dugesii misdet.*, p. 439

   Caucasus form (*porose areas of female united in median line of capitulum*)......................................*Rhipicephalus calcaratus*, p. 441

THE NORTH AMERICAN TEXAS FEVER TICK (*Boophilus annulatus*).[1]

(Figures 42-54, 59, 60, 62-64, 68, 151, 153a-b, 154a.)

SPECIFIC DIAGNOSIS.—*Boophilus: Male.*—Body oval, narrowed on front, broadest (1.3 mm.) at stigmal plane, 2.15 to 2.35 mm. long. Scutum reddish brown, covering entire dorsal surface, prolonged in front by two pairs of projections—one pair of more prominent dorso-lateral projections, dorsal of anterior projection of coxæ I, and one pair somewhat less prominent and more median, ventro-median of first pair and nearer the neck. Two cervical furrows shallow, extending more or less distinctly to the posterior border; may be somewhat interrupted in the middle; a median furrow present in posterior half, may be very indistinct; posterior margin of body divided into festoons which may be only slightly marked. Relatively large circular pores, with extruding short bristly hairs, scattered over entire surface. Eyes small and pale, often problematic, at I intercoxal space. Ventral surface lighter than dorsal, all portions provided with short stout hairs; genital pore, broad, transverse, between coxæ II; anus slightly posterior of stigmal plane; two pairs of anal plates (clypei): one pair elongate, rectangular to triangular, close to anus, in some cases extending cephalad to middle of coxæ IV, and caudad to near or beyond posterior margin, the anus being about at the middle of the length, in other cases extending from height of middle of stigmal area to beyond posterior margin of body; the median border longer than lateral border, the former prolonged into a point posteriorly, the postero-lateral margin may be nearly straight, or somewhat curved, or irregular in outline, thus presenting broad tooth-like projections; lateral and contiguous to each of these shields is found another shield somewhat similar in form but smaller in size. Median caudal appendage absent. Capitulum 450 to 500μ long, base similar to that of the female, but a little straighter, longer, more salient in front of dorsal shield, into which it penetrates by a sort of rectangular neck, lateral projections not very prominent. Mandibles 600μ long, digit about 90μ; internal apophysis with straight base and broad bifide point; external apophysis bidentate, the terminal subventral tooth may be very small while the proximal tooth is strong and large, or both may be large. Hypostome similar to that of female, four distinct rows of teeth on each half. Palpi about 190μ long, similar to those of female. Legs strong; coxæ large, those on each

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[1] SYNONYMY AND BIBLIOGRAPHY.

1821: *Ixodes annulatus* SAY, 1821, pp. 75, 76; type host, *Cervus virginianus*=*Cariacus americanus*, East Florida.—GERVAIS, 1847, p. 351. [Given as syn. of *Boophilus bovis* by CURTICE, 1891a, p. 318; 1891b, p. 685; DOLLY, 1894, p. 1000.—OSBORN, 1896, p. 257.] [See also NEUMANN, 1897, p. 407, as syn. of *Rhipicephalus annulatus.*—STILES & HASSALL, 1901, p. 3, as syn. of *Boophilus annulatus.*]

1869: *Ixodes bovis* RILEY, 1869, p. 168, and RILEY MS. in Packard, 1869, p. 68; type host, *Bos taurus;* Missouri.—VERRILL, 1870, p. 117, fig. 41.—PACKARD, 1873, pp. 740, 741.—LINTNER, 1874, p. 631.—MURRAY, 1877, pp. 182, 188, 193, 194.—COBBOLD, 1879, pp. 267, 350, 389.—JOHNSON, 1884, p. 78.—BEARDSLEE, 1884, pp. 84, 85.—COOK, 1888, p. 405.—NEUMANN, 1888, p. 95.—IDEM, 1892a, p. 100.—IDEM, 1892b, p. 103.—RILEY & HOWARD, 1889, p. 20.—THE LANCET, 1892, I, p. 756.—Vet. Journ., 1892, p. 337.—HOLLAND, 1898, p. 96.—HUNT, 1898, p. 211. [Given as synonym of *Boophilus bovis* by CURTICE, 1892, p.

243.—Dinwiddie, 1892, p. 7.—Osborn, 1896, p. 257.] [See also Neumann, 1896, p. 11.—Idem, 1897, p. 408.—Ward, 1900b, p. 437, as syn. of *Rhipicephalus annulatus.*]

1869: *Ixodes indentatus* Gamgee, 1869, p. 121, fig. 18=*Ixodes bovis* renamed.

1891: *Boophilus* (*Ixodes*) *bovis* (Riley) Curtice, 1891, p. 313.—Idem, 1891b, p. 680.—Morgan, 1894, p. 1004.

1891: *Boophilus bovis* (Riley) Curtice, 1891a, pp. 313–319.—Idem, 1891b, pp. 680–686.—Idem, 1892a, pp. 1–7.—Idem, 1892b, pp. 226, 231, 232.—Idem, 1892c, pp. 237–252, pls. I, II.—Idem, 1896, pp. 649–655.—Idem, 1897a, p. 24.—Marx, 1892, p. 236.—Dinwiddie, 1892, pp. 7–14.—Riley & Howard, 1893, p. 267.—Francis, 1894, p. 451.—Idem, 1895, pp. 210–213.—Miller, 1895, p. 11.—Fuller, 1896, pp. 760–787, pls. I–V [in part only].—Lugger, 1896, pp. 119, 120, fig. 57.—Osborn, 1896, pp. 257–260, pls. IV–V.—Connaway, 1897, pp. 85, 89, 97, figs. 1, 2, 5.—Hunt, 1897, pp. 231–233.—Lewis, 1897, p. 8.—Mayo, 1897, pp. 125, 126, 127, 129, fig. 1.—Dalrymple, Morgan, and Dodson, 1898, pp. 240–243, pls. II–VI.—Freer, 1898, pp. 256–260.—Niles, 1898a, pp. 27, 30, pl. II, figs. 1–6.—Idem, 1898b, p. 45.—Pound, 1898, pp. 404–407.—Bird, 1899, pp. 1, 5, figs. 1–6.—Lewis, 1899, pp. 3–5, figs. 1–2.—Morgan, 1899, pp. 128, 129, 130, 134, pls. I, II.—Lühe, 1900, p. 443.—Ward, 1900a, pp. 195, 201, 202, figs. 5–6.—Idem, 1900b, p. 437. [See also Neumann, 1897, p. 408, as syn. of *Rhipicephalus annulatus.*—Stiles & Hassall, 1901, pp. 2, 3, as syn. of *Boophilus annulatus.*]

1897: *Rhipicephalus annulatus* (Say) Neumann, 1897, pp. 384, 407–414, 419, figs. 37–40, in part.—Fuller, 1899, pp. 389, 391.—Ward, 1900a, pp. 201, 202.—Idem, 1900b, p. 437. [See also Stiles & Hassall, 1901, p. 2, as syn. of *Boophilus annulatus.*]

1897: "*Ixodes identatus* Gamgee" of Neumann, 1897, p. 408 (misprint for *Ixodes indentatus*).

1898: "*Boophylis bovis*" (Riley) of Niles, 1898b, p. 25, for *Boophilus bovis.*

1901: *Boophilus annulatus* (Say) Stiles & Hassall, 1901, pp. 2, 3.—Salmon & Stiles, 1901, pp. 420–426, figs. 42–54, 59, 60, 62–64, 68, 151, 153*a–b*, 154*a*.

side contiguous, as broad as long; coxæ I triangular, apex may be prolonged anteriorly beyond the corresponding anterior point of dorsal shield, reaching anterior angle of base of capitulum, or may be very short, base posterior and more or less distinctly bidentate, the teeth short, often slightly pronounced, or quite prominent, the lateral tooth in some cases prolonged into a well-marked spine. Tarsi like those of female.

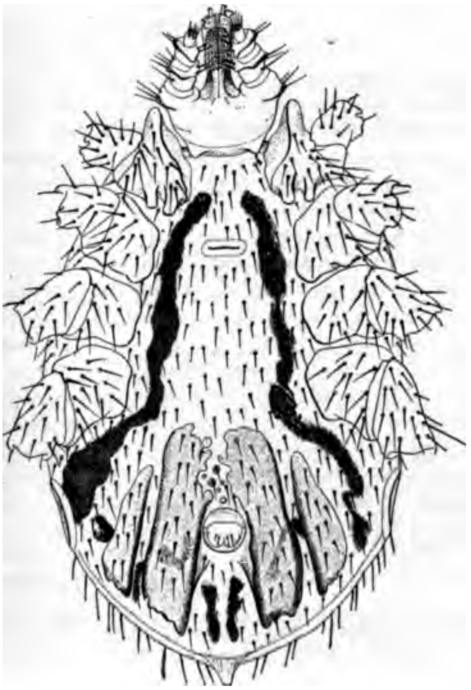

FIG. 142.—Ventral view of same specimen. In the living animal, a distinct peristalsis can be seen in the dark canals which shine through the integument. Original.

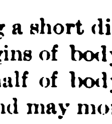

FIG. 143.—Stigmal plate of male. Greatly enlarged. Original.

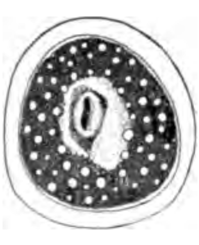

FIG. 144.—Stigmal plate of female. Greatly enlarged. Original.

Female.—Body elliptical, as broad in front as in back, usually somewhat constricted in middle, near IV pair of legs; may attain 13 mm. long, 7.5 mm. broad. Color exceedingly variable; live specimens vary from a tawny yellow (younger forms) to an olive green (very old specimens), alcohol specimens from yellow to red or black; the excretory system often shows through the cuticle as tortuous whitish canals. Dorsal shield (scutum) very small, visible as a dark brownish spot in a depression at anterior end of median line; usually about 1.1 mm. long by 0.8 to 0.9 mm. broad, decidedly emarginate anteriorly to receive capitulum; lateral borders nearly straight and parallel in anterior portion, from antero-lateral points to eyes, then convergent from eyes caudad, forming a more or less bluntly rounded posterior angle in median line; cervical grooves divide the anterior half of scutum into three more or less equal longitudinal fields, and diverge posteriorly; surface of scutum provided with short bristles which are more numerous near anterior border and near the eyes than elsewhere. Eyes rather small near anterior third of margin of scutum. On nearly the entire length of dorsal surface of body are two antero-posterior grooves, interrupted or nearly effaced near plane of IV pair of legs, and ending a short distance from the shield and from posterior margins of body; also an unpaired median groove in posterior half of body; all three vary with the muscular contractions and may more or less completely disappear when body is replete. Ventral surface shows four pairs of more or less distinct marginal constrictions corresponding to the four pairs of legs, the IV constriction being most marked, antero-median region also depressed at insertion of capitulum; vulva small, median, at plane of coxæ I; sexual grooves corresponding to the paired dorsal grooves; but showing some variation in different specimens; median groove extending from anus to posterior margin. Anus about on border of second and last thirds of body. Stigmata short oval; stigmal pore slightly crescentic, convexity lateral; stigmal field with numerous larger and smaller wart-like structures forming a zone near the margin. Cuticle of entire body finely wrinkled, bearing short hairs. Capitulum very short, about 800 μ from posterior dorsal margin to anterior end of hypostome; base of capitulum hexagonal, enlarged on its dorsal surface; inserted in emargination of scutum; lateral projections not very prominent. Mandibles 860 μ long, digit 120 μ. Internal apophysis conical (Neumann), bidentate (Fuller), with its base near the terminal extremity; external apophysis with three successive teeth, one terminal, subventral, small; the second stronger; third large. Hypostome rather spatulate, broad, a little longer than the palpi, provided on each half with four rows of nine to ten nearly regular denticles which do not extend to the

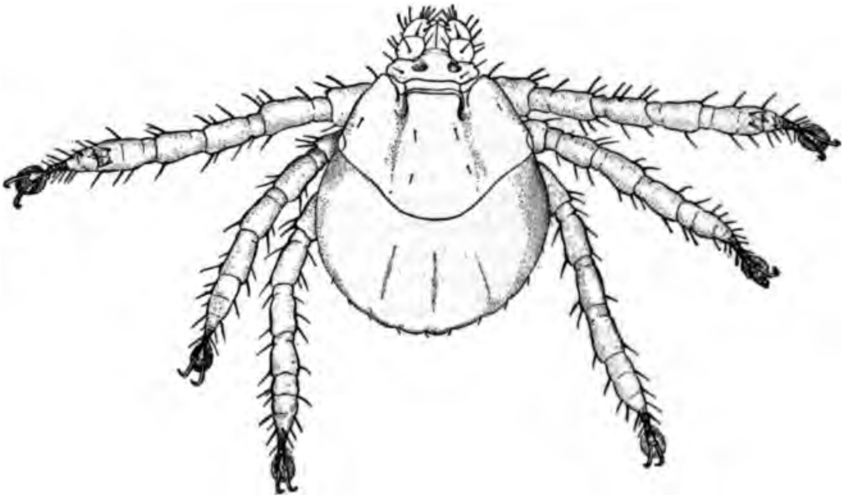

FIG. 145.—Dorsal view of hexapod larva of *Boophilus australis*,

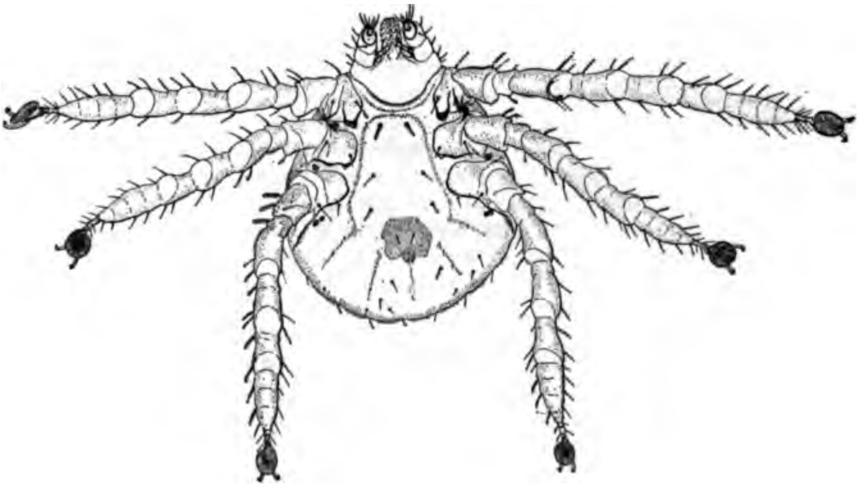

FIG. 146.—Ventral view of hexapod larva of same.

base. Palpi very short (310 μ), subconical, articles at least as broad as long; first article partially hidden under the antero-dorsal border of the base of the capitulum; second article pedunculate, dilated in a salient crest in its middle portion, thus forming a prominence inward (toward median line) and outward, and provided with strong hairs, especially on the inner prominence; third article smaller, subtriangular on its dorsal surface, where it forms a projection in and out; fourth article small, cylindrico-conical, inferoterminal. Legs rather thin, short (pair I, 2 mm.; pair II, 2.5 mm.), yellowish brown, first articles darker than the others. Coxæ: pair I subtriangular, posterior border bidentate or biundulate, the division in many cases indistinct. Tarsi I unicalcarate, II to IV bicalcarate. Pulvillum about half as long as claws. Stiff bristle-like hairs on all articles.

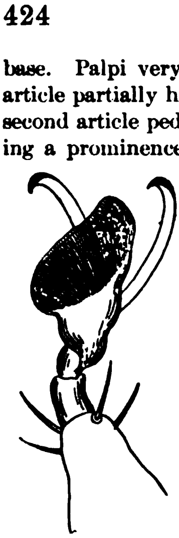

FIG. 147.—Dorsal view of claw I of hexapod larva of same. Original.

Hexapod larva.—Body oval, slightly narrowed in front, about 600 μ long and 470 μ broad, yellowish. Scutum thin, covering more than half the back, scarcely emarginate for capitulum. Short hairs on dorsal and ventral surfaces. Capitulum as broad as long; base a rectangle transversely elongate on dorsal surface, semicircular ventral surface. Mandibles 240 μ long, digit 32 μ, of same type as in male. Hypostome rather spatulate, provided on each half with two rows of five to seven teeth of nearly equal size. Palpi with nearly cylindrical articles, without lateral projections, provided with long hairs; fourth article relatively large, inserted on median surface of third. Legs relatively strong; coxæ somewhat similar to those of male; tarsi without spurs. Stigmata small, circular, between coxæ II and III, and posterior of coxæ III; possibly also between coxæ I and II.

Habitat.—On cattle and deer; southern portion of United States of North America; its southern limit is not established. Transcontinental quarantine line is based upon this species, which is the transmitter of Texas fever.

Historical review of Boophilus annulatus.

In 1821 Say described a North American tick as follows:

> Body oval, pale reddish brown, tinged with sanguineous, particularly behind, and with several longitudinal and oblique, black, abbreviated lines, scattered punctures, and three abbreviated, longitudinal impressed lines behind; *rostrum* [= capitulum], with the *palpi* dilated, rather suddenly contracted at base, and annulated more prominently beneath with about two elevated lines, which on the sides produce an angulated appearance, much shorter than the haustellum [= mandibles + hypostome], rounded at tip; *haustellum*, the two superior organs [= mandibles] emarginate at tip, exterior division dentate beneath, inferior organ [= hypostome] with numerous resupinate teeth [= denticles] resembling fenestrate punctures; posterior to the origin of the palpi above is an orbicular, obscure assemblage of punctures [= porose area] resembling eyes; black dorsal lines of the male somewhat regular, consisting usually of a dorsal line divaricating before, and behind, the middle, furnishing a branch each side, which at the tip of the abdomen is confluent with a lateral line, which also branches off in two or three short lines towards the feet; *feet* with a short, robust nail, and a reclivate pedunculated pulvillus and nails.
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> Found in considerable numbers on a *Cervus Virginianus*, in east Florida.

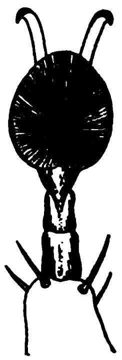

FIG. 148.—Ventral view of same. Original.

It will be noticed that Say's specimens were taken in Florida from the Virginia deer (*Cervus virginianus* = *Cariacus americanus*), hence this is the type host, while Florida is the type locality for the species *B. annulatus*. There is, however, scarcely room for serious doubt regarding its identity with a tick described in 1867 by C. V. Riley, late Entomologist of the U. S. Department of Agriculture, as a new species, *Ixodes bovis;* type host, neat cattle; type locality, Missouri. Riley's original diagnosis reads:

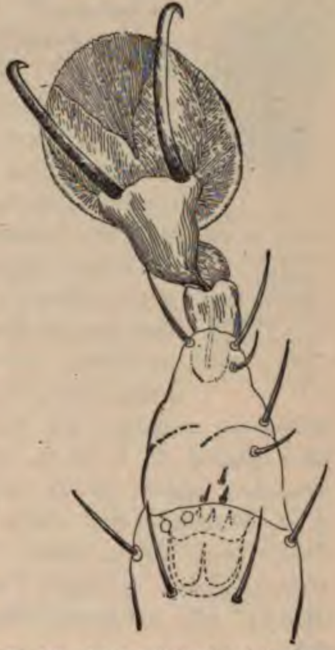

FIG. 149.—A view of claw II of *Boophilus australis*, same magnification as figs. 147 and 148.

> *Ixodes bovis* (Riley). A reddish, coriaceous, flattened species, with the body oblong-oval, contracted just behind the middle, and with two longitudinal impressions above the contraction and three below it, more especially visible in the dried specimen. Head short and broad, not spined behind, with two deep round pits. Palpi and beak together unusually short, the palpi being slender. Labium [= hypostome] short and broad, densely spined beneath. Mandibles smooth above, with terminal hooks. Thoracic shield distinct, one-third longer than wide, smooth and polished; convex, with the lyrate medial convexity very distinct. Legs, long and slender, pale testaceous red; coxæ not spined. Length of body, 0.15 of an inch; width, 0.09 of an inch. Missouri Coll., C. V. Riley.
>
> This is the cattle tick of the Western States. Several hundred specimens in different stages of growth have also been received from Pulvon, west coast of Nicaragua, taken from the horned cattle, and on a species of dasyprocta, by Mr. J. McNeil. They preserve the elongated flattened form, with the body contracted behind the middle, by which this species may be easily identified. The largest specimens measure 0.50 by 0.30 of an inch. When gorged with blood they are nearly as thick through as they are broad. In the freshly hatched hexapodous young, and the young in the next stage of growth, the thoracic shield is one-third the size of the whole body, which is pale yellowish, with very distinct crenulations on the hinder edge. The fourth pair of legs are added apparently at the first molt. It is called the "garapata" by the inhabitants of Nicaragua.

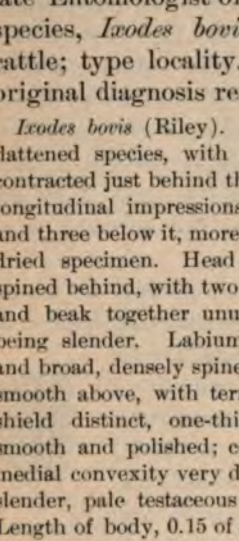

FIG. 150.—A view of claw II of same; magnification same as figs. 147 and 148.

In the same departmental publication in which Riley published his description of *I. bovis*, Gamgee proposed to call the same tick *Ixodes indentatus*. No question can arise, therefore, regarding the identity of *I. bovis* and *I. indentatus*. Packard (1873, p. 740) copied Riley's diagnosis, but gave a figure of the female of a *Dermacentor* instead of the true *I. bovis*. He states that Merriam collected *I. bovis* in 1870 from a porcupine (*Erithizon epixanthus*) in Idaho, and that it was also taken in Wyoming in 1873 from a rabbit (*Lepus Bairdii*). If the determination was correct, these must have been ticks carried north by Southern cattle, for *B. annulatus* does not normally occur so far north. Murray (1877, pp. 193, 194) says that a specimen was taken from a miner's neck in Utah, and he thinks that the tick on the moose referred to by Capt. Campbell Hardy (Forest Life in Acadie, 1869) is identical with this form. It seems more probable, however, that Hardy's form is *Dermacentor variegatus*, and there are some doubts in our minds regarding the correctness of the determination in the Utah case.

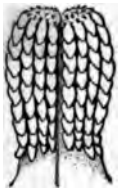

FIG. 151.—Diagram of the labium of *Boophilus annulatus* and *B. australis*. After Fuller, 1899, p. 391, fig. 11.

Curtice (1891) proposed *Ixodes bovis* as type of a new genus, *Boophilus*. It was also Curtice who suggested that this species was possibly identical with *Ixodes annulatus* and *Hæmaphysalis rosea*. Curtice's genus *Boophilus* has been generally accepted by American authors, but was rejected by Neumann (1897), who placed *B. bovis* in *Rhipicephalus* as *R. annulatus*. Neumann unites under this species the following forms: *Ixodes annulatus* Say, 1821; *Hæmaphysalis rosea* Koch, 1844; *Ixodes bovis* Riley, 1869; "*I. Dugesii*" of Mégnin, 1880; *Hæmaphysalis micropla* Canestrini, 1887; *Boophilus bovis* (Riley); *Rh. calcaratus* (Birula), 1895; *Rh. annulatus caudatus*.

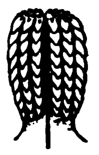

FIG. 152.—Diagram of the labium of *B. decoloratus* and *Rhipicephalus Evertsi*. After Fuller, 1899, p. 391, fig. 12.

Fuller (1899) compared the North American, the Australian, and the South African forms and considered that they represented distinct species (see below, p. 430). He follows Neumann by not adopting *Boophilus*.

THE AUSTRALIAN, SOUTH AMERICAN, CUBAN, AND PORTO RICAN TEXAS FEVER TICK (*Boophilus australis*).[1]

(Figures 114–151, 153*d*, 154*c*.)

SPECIFIC DIAGNOSIS.—*Boophilus: Male.*—Body oval, narrowed in front, broadest (about 1.3 mm.) in region of stigmata and coxæ IV, 2.2 to 2.3 mm. long. Scutum reddish brown, extends from anterior to posterior margin of body, but leaves a narrow lateral margin uncovered, prolonged in front by two pairs of projections; one pair of

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[1] SYNONYMY AND BIBLIOGRAPHY.

1887: ? *Rhipicephalus micropla* CANESTRINI (1887) (see below, p. 437).
1897: ? *Rhipicephalus annulatus caudatus* NEUMANN, 1897 (see below, p. 437).
1899: *Rhipicephalus australis* FULLER, 1899, pp. 389–394, figs. 3. (See also STILES & HASSALL, 1901, p. 2.)
1900: "*Boophilus bovis* (Riley)" of FULLER, 1898, pp. 760–787 [in part] and LIGNIÈRES 1900, pp. 88–96, pls. X–XI.
1901: *Boophilus australis* (Fuller) STILES & HASSALL, 1901, pp. 2, 3.—SALMON & STILES, 1901, pp. 426–433, figs. 114–151, 153*d*, 154*c*.

PLATE LXXX.

FIG. 114.—Dorsal view of male *Boophilus australis*, from Cuba. Natural size. Original.

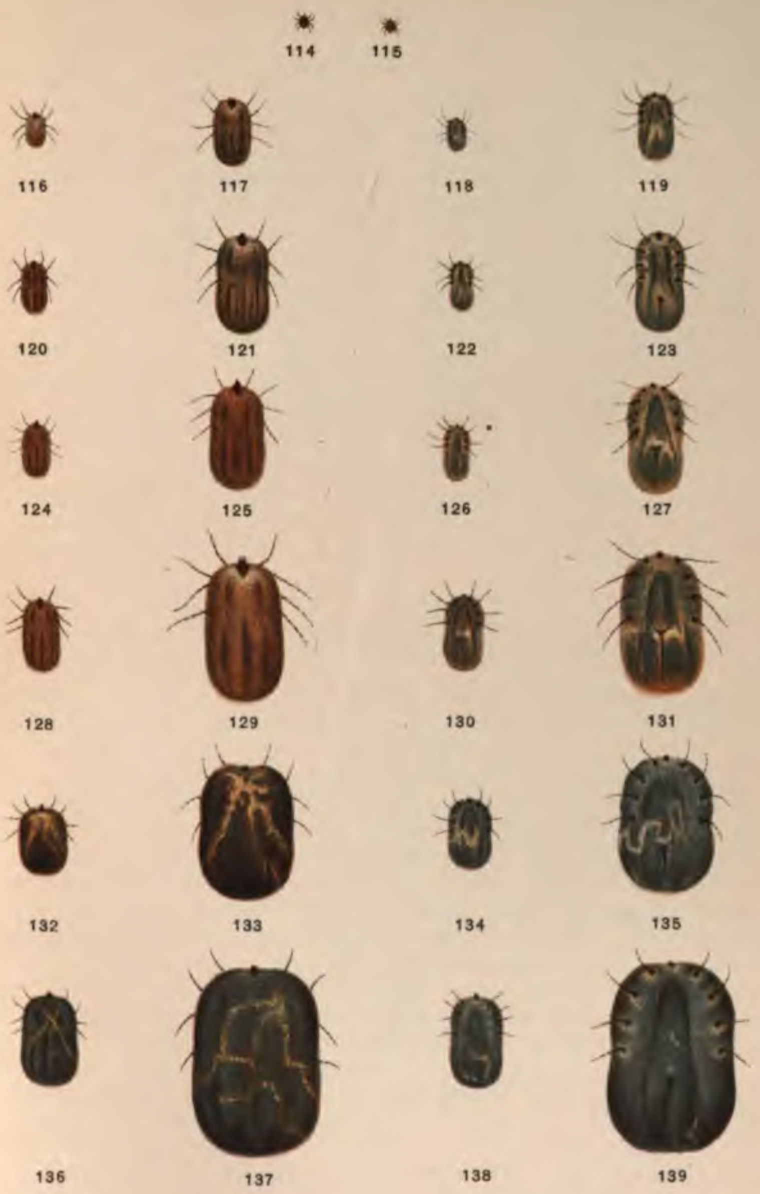
FIG. 115.—Ventral view of same.

FIGS. 116, 120, 124, 128, 132, 136.—Dorsal view of female *Boophilus australis*, from Cuba, showing variation in color and form. Natural size. Original.

FIGS. 117, 121, 125, 129, 133, 137.—The same, twice natural size.

FIGS. 118, 122, 126, 130, 134, 138.—The same, ventral view.

FIGS. 119, 123, 127, 131, 135, 139.—The same, twice natural size.



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A. Hoen & Co., Lithocaustic.

DORSAL AND VENTRAL VIEWS OF MALE AND FEMALE BOOPHILUS AUSTRALIS.

more prominent dorso-lateral pointed projections, dorsal of anterior projections of coxæ I, and one pair less prominent and more median, somewhat semilunar with concavity median, surrounding the base of the neck. Two shallow cervical furrows, extending more or less distinctly to posterior margin of body, may be interrupted in the middle; a median furrow present in posterior half, may be indistinct; festoons of posterior margin very indistinct. Distinct circular pores with extruding short, stout bristly hairs scattered over entire surface. Eyes small, pale, at I intercoxal space. Ventral surface lighter than dorsal, all portions provided with short, stout hairs. Genital pore broad, transverse, between coxæ II. Anus slightly posterior of stigmal plane; anal plates (clypei) more chitinous than those of *B. annulatus.* Strong chitinous cervical median caudal appendage present, 85 μ long. Capitulum about 425 μ long, postero-lateral spines of base more marked than in *B. annulatus;* mandibles about 600 μ, digit about 90 μ; internal apophysis apparently with three teeth; external apophysis bidentate (only 3 specimens examined). Hypostome with four rows of teeth on each half, the inner row may be less strongly developed than the others.

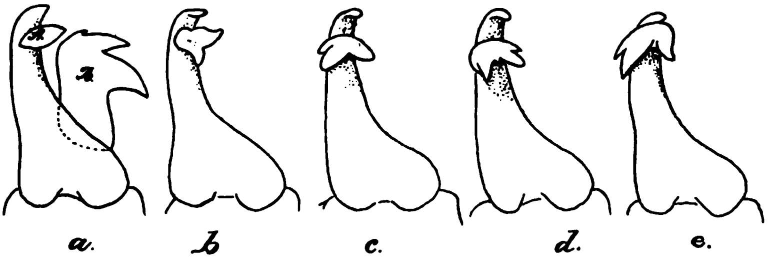

FIG. 153.—Diagrams of mandibles: *a, b, Boophilus annulatus; c, B. decoloratus; d, B. australis; e, Rhipicephalus Evertsi.* After Fuller, 1899, p. 391. *a* and *e* from Neumann.

Palpi about 200 μ long, in general similar to those of *annulatus.* Legs strong; coxæ similar to those of *annulatus,* but bidentation of I pair much more marked. Tarsi similar to *R. annulatus.*

Female.—Very similar to female of *B. annulatus,* but the lateral constriction at the stigmata is usually more marked. Body elliptical, as broad in front as in back; when replete, may attain 10 to 12 mm. long by 6 to 7 mm. broad. Color varies like *annulatus.* Dorsal shield smaller, somewhat lighter in color. Eyes small, near middle or anterior third of lateral margin of scutum. Capitulum very short, 560 to 612 μ from postero-dorsal margin to anterior end of hypostome, quite similar to that of *annulatus* except lateral projection slightly more marked. Mandibles 765 μ long, digit 120 μ; internal apophysis "tricuspid, and presenting a rounded process as well;" external apophysis tridentate as in *annulatus.* Hypostome spatulate, slightly longer than palpi, each half with four rows of 7 to 10 denticles which do not extend to the base. Palpi very short, about 320 μ long, articles at least as broad as long, in general similar to *annulatus.* Legs similar to *annulatus.*

Hexapod larva.—Similar to *R. annulatus;* in some cases a third pair of stigmata (between coxæ I and II) appears to be present.

Historical review of Boophilus australis.

The Australian and South American fever ticks were originally considered as identical with *B. annulatus.* When the Australian commission visited this Bureau, the writers of the present paper examined the Australian forms and expressed the opinion that they were certainly a distinct variety and in all probability a distinct species. The same specimens were examined by Ashmead, Schwarz, and Coquillette, who concurred in this view. This opinion was referred to by our Australian colleagues in one of their publications (Hunt and Collins, 1896, pp. 31, 32). Neumann, who examined the same specimens upon which we had based our view, looked upon the Australian form as identical with the North American. Fuller (1899, pp. 389–394), however, restudied the question and recognized the North American, the Australian, and the South African forms as three distinct species. The following extracts from his paper bear upon the question involved:

> Together with this I am sending you some notes on the various cattle ticks, from which you will see that I have found the North American, the Australian, and that from Cape Colony distinct from one another. The Queensland form appears to be a new species, for which I have proposed the name *australis;* it is curious that it is the same as the one Mr. Pound sent me as coming from South America.
>
> These notes I have written in a form suitable for reproduction in your Agricultural Journal, in the pages of which I should like to see them reproduced. Drawings suitable for making zinc blocks from are also sent, which, if added as illustrations, will render the notes much more valuable.

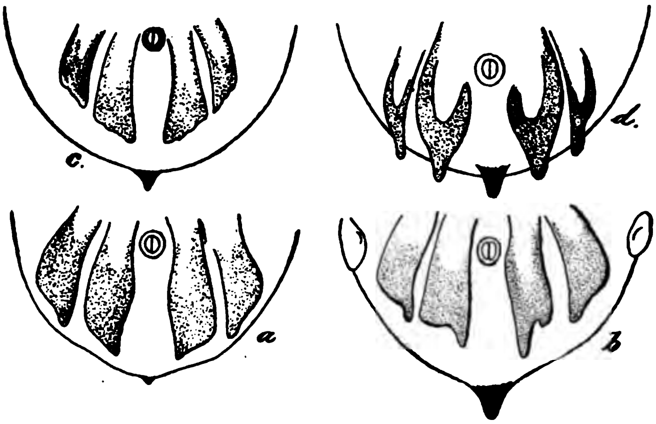

FIG. 154.—Diagrams of posterior margin of males: *a*, *Boophilus annulatus;* *b*, *Rhipicephalus caudatus;* *c*, *B. australis;* *d*, *B. decoloratus.* *a* and *b* from Neumann. After Fuller, 1899, p. 392.

> As early as 1893 the Queensland cattle tick was identified as *Ixodes bovis* Riley, by the late A. S. Olliff, and was until recently regarded as specifically identical with that species by many later students. I believe that the first doubt as to the correctness of this assumption was thrown out by Dr. D. E. Salmon, Chief of the U. S. A. Bureau of Animal Industry, in a letter to Mr. P. R. Gordon, chief inspector of stock (Queensland). In this communication (dated 9th December, 1897) Dr. Salmon says: ‘You will possibly recall that we considered the Australian form distinct from our American form. Professor Neumann—who had for his monograph a very large number of specimens, including our entire collection, and has studied the Australian ticks which Dr. Hunt gave us some time ago—does not, however, agree with us on this point, but considers that they are identical."
>
> As it has since become important to settle the identity of the supposed redwater tick in Cape Colony, also said to be *I. bovis*, I have made a careful study of all three forms, and have come to the conclusion that they are three distinct species.

The specimens of *Rhipicephalus annulatus* Say (*Ixodes* (*Boophilus*) *bovis*) were kindly furnished through Mr. C. P. Lounsbury by Dr. L. O. Howard, entomologist, U. S. A., Dr. M. Francis, of Texas, and Prof. H. A. Morgan, of Baton Rouge, La. The Australian form and a few from South America, which prove to be identical with it were very kindly sent to me by my friends, Messrs. P. R. Gordon, chief inspector of stock, and C. J. Pound, director of the stock institute, Queensland.

The local Blue Tick, of which I have specimens from eastern and western parts of the colony, I regard as *Rhipicephalus decoloratus*, an insufficiently described species of Koch. Koch's description of this species is so meager that it is impossible to gather more from it than that he had a single specimen from the Cape of Good Hope, which was, judging from the color, an unimpregnated and undersized female. He figures the shield with two furrows, dividing it into three regions, the median yellow, the laterals red; and it is this feature, also noticed by Neumann, who had the opportunity of studying the original type, which has chiefly guided me in determining the species as *decoloratus*, there being no other species recorded from South Africa, or known to me, which possesses the same coloration of the dorsal shield.

The Australian species, also sent as from South America, is quite distinct from either the North American or the South African, and is therefore looked upon as a new species, for which the name *australis*, by which it is subsequently referred to, is proposed.[1]

The genus *Rhipicephalus*, to which the above species belong, has been reviewed by Professor Neumann, in an excellent treatise entitled a "Revision de la Famille des Ixodes,"[2] a work that has been of the greatest assistance in making these comparisons, so that it is with great regret that I find that I am at variance on one or two points with this most learned savant.

The genus, as may be gathered from the revision just quoted, contains some sixteen recognizable species which may be readily divided into two well-defined groups by referring to the number of furrows in the dorsal shield of the adult female; there being two in some species and four in others. The ticks under discussion belong to the former group, which appears to contain six species, namely, *annulatus* and Neumann's variety, *caudatus* (which I am prepared to regard as a distinct species), *Evertsi*, *pulchellus*, *decoloratus*, and the Australian-South American form, *australis*. Of these only *annulatus*, *decoloratus*, and *australis* have been studied directly, the characters of the rest being those given by Neumann, which are excellent descriptions, my North American specimens fully according with that of *annulatus*, except as regards the smaller process of the mandibles. This minute but important feature Neumann describes as being in the form of a simple cone; with this I do not agree, as, in the specimens I have examined, it is distinctly bicuspid, the additional tooth being often difficult to detect, as it is implanted at right angles to the more prominent one. The species is also credited with a very large geographical distribution, which includes parts of America and the West Indies, Australia, Asia, Sumatra, and Africa. I, however, have failed to find it among such ticks as I have from South America, Australia, and Cape Colony.

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[1] Mr. H. Tryon, entomologist to the Queensland department of agriculture, had already in an official report on the subject of the identity of this tick, on 1st February, 1899, pronounced on the distinctness of the Queensland cattle tick from *Ixodes bovis*. This officer, in the report alluded to, stated as follows: "These ticks are undoubtedly examples of *Ixodes bovis*, or rather of the Queensland variety of it, regarding which it may be stated that this differs slightly, as would appear from the typical form."—Ed. Q. A. J.

[2] Memoires de la Société Zoologique de France, Vol. IX, page 1, 1896, and Vol. X, page 324, 1897.

The chief characters which I have found of use in distinguishing the various species studied are: (1) The furrows of the dorsal shield of the female; (2) the number of rows of teeth to the labium or hypostome; (3) the form of the mandibles, particularly the lesser process (the internal apophysis of Neumann); (4) the extent of the dorsal shield of the male; and (5) the presence or absence of a "tail" to the male.

The following tables indicate the bearing of these features upon the species:

1. A. Furrows of the dorsal shield of the female extending to the posterior lateral margins: *R. annulatus, caudatus, Evertsi, decoloratus*, and *australis*.
   B. Furrows becoming obsolete in the middle of the shield at about half its length: *R. pulchellus*.

(This feature removes *pulchellus* from all others.)

2. A. Labium, or hypostome, with ten rows of teeth: *R. caudatus* (Neumn.).
   B. Labium, or hypostome, with eight rows of teeth: *R. annulatus* and *australis*.
   C. Labium, or hypostome, with six rows of teeth: *R. Evertsi* and *decoloratus*.

(This feature separates *caudatus* from the four remaining species and helps to separate *annulatus* and *australis* from *Evertsi* and *decoloratus*.)

3. A. Mandibles with lesser process, bicuspid: *R. annulatus*.
   B. Mandibles with lesser process, tricuspid (Neumn.): *R. Evertsi*.
   C. Mandibles with lesser process, bicuspid, and presenting a rounded projection as well: *R. decoloratus*.
   D. Mandibles with the lesser process, tricuspid, and presenting a rounded projection as well: *R. australis*.

(This feature differs in each species; there is a slight similarity between *annulatus* and *decoloratus* and *Evertsi* and *australis*.)

4. A. Male with the shield extending to the posterior margin: *R. annulatus, caudatus, decoloratus, australis*.
   B. Male with the shield not extending to the posterior margin (Neumn.): *R. evertsi*.

(This appears to be a ready feature for distinguishing *Evertsi* from *decoloratus*.)

5. A. Male with a distinct horny "tail:" *R. caudatus, decoloratus*, and *australis*.
   B. Male with small caudal protuberance: *R. Evertsi*.
   C. Male with no indication of a "tail:" *R. annulatus*.

(The absence of a tail to the male of *annulatus* readily separates it from the other species.)

From the differences in the various characters, brought out in the above tables, I have felt myself justified in reestablishing Koch's *R. decoloratus*, and in regarding the Australian tick as a new species. The following brief descriptions will, I think, suffice for the recognition of *australis* and *decoloratus*:

Rhi[*pi*]*cephalus decoloratus* Koch ("Uebersicht des Arachnidensystems," page 134.)

Female.—When replete, 10–12 mm. in length, and 6–8 mm. in breadth. Color uniform, slate blue. Shield of the same form as that of *annulatus* and *australis*, but smaller; furrows at first converging, then diverging to the posterior lateral margins; median region of a light yellow color, laterals red. Eyes not distinct. Labium with six rows of teeth. Mandibles with lesser process bicuspid, and presenting a rounded process as well. Legs generally yellowish, often red.

Male, adult.—Pale brown, and almost transparent, sometimes dark brown. Length, 2–3 mm. Labium with six rows of teeth. Adanal shields four, of the usual form, but more chitinous than those of *annulatus*, and prolonged into strong conical points. Abdomen ending in a strong chitinous caudal appendage.

Habitat.—On horses, cattle, etc.; Cape of Good Hope.

Rhipicephalus australis, n. sp.

Female.—When replete, measuring 10–11 mm. in length and 6–7 mm. in breadth. Dorsal shield smaller than that of *annulatus* and greater than that of *decoloratus*, of the same form and with similar furrows. Eyes, pale. Labium with eight rows of teeth. Mandibles with the lesser process tricuspid, and presenting a rounded process as well.

Male, adult.—Approaching that of *annulatus*, but with adanal shields more chitinous, and also exhibiting a caudal appendage. Neither the shields nor the "tail" are so pronounced as those of *decoloratus*.

Habitat.—On horses, cattle, etc.; northwest to northeast Australia.

For some time now there appears to have been doubt as to the identity of the Redwater ticks of Australia and North America with one another, and also with the supposed carrier of Redwater in Cape Colony—the Common Blue, or Blood, Tick. With the object of settling this point, at any rate so far as the common species in Cape Colony is concerned, a careful study has been made of these three forms, and the following notes are the results of these comparisons:

The fact that Redwater is carried from beast to beast by the agency of ticks was discovered but a few years ago by official investigators in the United States of America, where the disease has been the direct cause of great losses from time to time. These investigators found that one kind of tick, *Rhipicephalus annulatus* (Say) or, as it is more commonly known, *Ixodes bovis*, was the agent which disseminated the disease, and proved that not only did the bites of the ticks produce the disease, but, further, that the disease, or power of producing it, was communicated from the maternal tick through its eggs to the young. Subsequently, when this Redwater broke out in Queensland, Australia, it was found associated with a tick which many of us regarded as identical with the American one, and as this tick spread from district to district, so the disease spread with it. In Cape Colony, Redwater has been gradually extending its range from the north along the eastern seaboard, and the common Blue, or Blood, Tick is no doubt the chief distributing agent. This species is referred to as the supposed or chief distributing agent of the disease, because of the great possibility that it is not the only agent, nor the only tick, for there is a probability that some, if not all, of our other common species, such as the larger Blue, the Red,[1] and the two Bontes,[1] may also act as transmitters; a probability enhanced by the fact that these investigations have shown that the Australian, the North American, and the local Common Blue, though closely allied and of the same genus, are distinct species. But as, up to the present, there does not appear to be any conclusive technical evidence upon this important point, I venture to draw attention to it as being a question invested with so much interest and practical importance that it is well worthy of attention, particularly in Cape Colony, where the opportunities of investigating it are so great.

Another interesting feature is that whilst in Australia and, I believe, the United States too, the ticks were strangers to those parts to which they carried the disease, such is not the case in Cape Colony. Our Blue Tick (*Rhipicephalus decoloratus* Koch) occurs in many parts of the colony, and is found where, I am given to understand, Redwater has never been known and where cattle could not have become immune. That the ticks are actually dissociated from the disease in these parts is proved by the fact that imported cattle do not contract Redwater when brought into contact with the native cattle. In Australia and North America the ticks have never, to my knowledge, been reported as so dissociated from the disease, and fever-stricken cattle were always infested with a particular tick, and unless a beast was actually immune by birth or had become so by previous infection or inoculation, the bites of these

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[1] Red tick=*Rhipicephalus Evertsi*. The Bonte tick=*Amblyomma hebræum*. The Bonte leg tick=*Hyalomma ægyptium*.

> ticks were followed by the fever. There are, however, in both countries, particularly in the more southern and warmer parts of the United States, parts where tick-infested cattle exist in great numbers and do not suffer from acute Redwater. These cattle are, however, natives, and inherit their immunity from the disease while still carrying in their blood its "germs." From them the ticks are known to take the disease to susceptible cattle, either when mixing with these other cattle or grazing over the same ground within a certain period after they have crossed it. These susceptible animals have the disease carried to them by the young, or larval, ticks hatching from the eggs laid by those dropping from the former cattle. Ground traveled over by the cattle which carry the disease in their blood remains infected with the disease only so long as it is infested with these larvæ, and this period is limited by the length of time that they can live without food. This again, providing there is no reinfestation, is more or less extended according to climatic conditions—heat and cold, dryness and dampness, young ticks being very subject to such variations and capable of living a great while when they are favorable. Ground is said to remain infested for as many as six months in winter and two in summer in the case of the American Redwater tick, of which it is recorded that—[1]
>
> (1) The delay in the beginning of egg laying is nearly three weeks in winter as compared to twenty-four to forty-eight hours in summer.[2]
>
> (2) The time elapsing between the laying of the first and the last egg by a female is, in summer temperature, only a few days, while in winter it may extend over a period of five weeks.
>
> (3) In winter incubation is almost suspended, and months may elapse before hatching takes place. In summer the normal incubation period is about twenty days.
>
> (4) Seed ticks (larvæ) are capable of existing without food four and one-half months in winter; in summer the time survived was about two months.
>
> The short summer period does not, I am told by Mr. Hutcheon, C. V. S., actually apply to our local conditions, as there are certain evidences of veldt remaining infected for far greater periods.

We have recently received some ticks from Porto Rico, which resemble the Australian form in all essential details, except that the teeth on the internal apophysis—which both Neumann and Fuller discuss and figure as if they were easily studied—have baffled us. These characters may be of value in classification, as claimed by Fuller. On the other hand, we have not found them to be practical working characters; and, as the teeth on the external apophysis of *Boophilus annulatus* are subject to considerable variation, we are somewhat suspicious regarding those on the internal apophysis.

The Porto Rican ticks in question when first sent to Washington were much smaller than the North American form, resembling more closely the Australian specimens. After several generations, however, they became more elongate and resembled the North American form so closely that the females can not possibly be distinguished with the naked eye, and a microscopic determination is very uncertain. The

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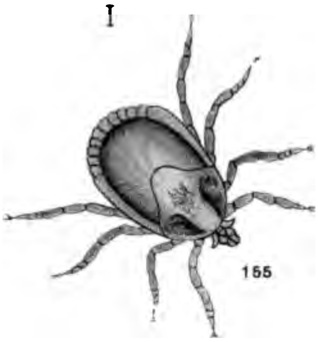
[1] "The following information is quoted from Bulletin 51 (2d Ser.) of the Louisiana State University and A. & M. College. The Cattle Tick and Texas Fever, by W. H. Dalrymple, H. A. Morgan, and W. R. Dodson. Baton Rouge, 1898."

[2] "In the case of the Bonte Poorten Tick (*Amblyomma hebræum* Koch) we find that there was a delay of from two to three months in beginning egg-laying in winter (May to July), and about a week in summer (January)."



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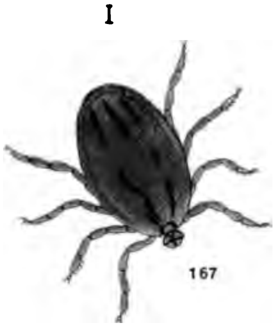

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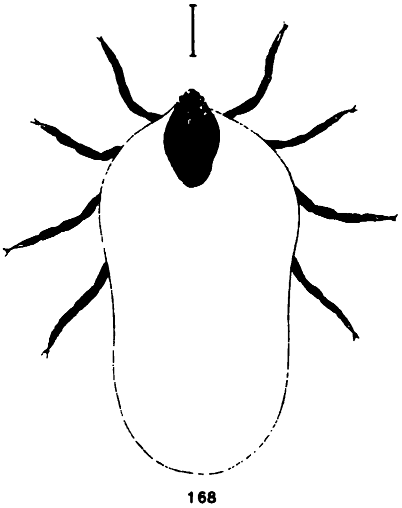

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A Hoen & Co. Lithocaustic

FIG. 155. ORIGINAL FIGURE OF BOOPHILUS DECOLORATUS. AFTER KOCH, 1847, PL. 30, FIG. 110.

FIG. 167. ORIGINAL FIGURE OF MALE RHIPICEPHALUS ROSEA. AFTER KOCH, 1847, PL. 26, FIG. 95.

FIG. 168. ORIGINAL FIGURE OF FEMALE RHIPICEPHALUS ROSEA. AFTER KOCH, 1847, PL. 26, FIG. 96.

males, however, have remained perfectly distinct. Some specimens of ticks in our collection (B. A. I. Coll. 2997) taken at Boston from Venezuelan cattle, also B. A. I. Coll. 2977–2979, from Mandalay, Prone, and Shongwa Districts, India, agree with the Porto Rican forms in the two most important characters—eight rows of teeth on hypostome and presence of a tail in male—while no differences in other characters have been noticed.

At the Bureau Experiment Station, Dr. Schroeder has transmitted Texas fever by means of the Porto Rican tick.

Lignières (1900), in connection with his discussion of bovine malaria (Texas fever) in Argentina, mentions (p. 92) and figures (pl. XI, fig. 1) on the posterior extremity of the male a prolongation which he interprets as a penis. This is quite evidently the same as the caudal appendage of *B. australis*. Lignières erroneously supposes the Argentine form to be identical with our North American species. Apparently, Lignières found two rows of teeth on each half of the hypostome of the hexapod larva, three rows on each half in the nymph, and four rows in the adult female and male. Thus the presence of the tail in the male and eight rows of denticles in adult males and females would seem to indicate that the Argentine tick is identical with the Australian, Porto Rican, Cuban, and Venezuelan.

Canestrini's description of *Rhipicephalus micropla* is not accessible to us, but from the fact that Neumann (1897) has considered it identical with his *caudatus*, while Birula says that it is very closely related to his *calcaratus*, the possibility does not appear to be excluded that *australis* and *micropla* are specifically identical. This view gains in probability when we recall that *micropla* comes from Paraguay.

The Blue Tick of South Africa (*Boophilus decoloratus*).[1]

(Figures 152, 153*c*, 154*d*, 155.)

Specific diagnosis.—*Boophilus: Male.*—Pale brown and almost transparent, sometimes dark brown. Length, 2 to 3 mm. Labium with six rows of teeth. Anal shields, four, of the usual form, but more chitinous than those of *annulatus*, and prolonged into strong conical points. Abdomen ending in a strong chitinous caudal appendage.

Female.—Body (when young) oval, sides slightly convex, posterior portion scarcely broader than anterior in specimens 2.2 mm. long by 1.3 mm. broad; when replete may attain 10 to 12 mm. in length, 6 to 8 mm. in breadth; color, uniform slate blue. Scutum of young longer than broad, rounded sides, punctations very superficial and very fine, brilliant, yellow in median portion, red on the sides, lateral of the anterior grooves; eyes red. Scutum of adults of same form as that of *B. annulatus* and *B. australis*, but smaller; furrows at first converging, then diverging to the posterior lateral margins; median region of a light yellow color, laterals red. Eyes not distinct. Dorsal surface of young yellowish white, smooth, the black intestinal ramifications showing through; lateral margin raised, without marginal groove, posterior festoons slightly apparent. Ventral surface yellowish, with underlying black spots; anus reddish. Capitulum red, base very short and broad; posterior angles scarcely salient, anterior and posterior, also antero-lateral and postero-lateral borders equal. "Mandibles with lesser [internal] process bicuspid, and presenting a rounded process as well." Hypostome with six rows of teeth (three on each lateral half). Legs generally yellowish, often red; coxæ contiguous; coxæ I with two short teeth; tarsi short with two consecutive spurs; pulvillum short, scarcely one-third as long as the claws.

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[1] Synonymy and Bibliography.

1844: *Rhipicephalus decoloratus* Koch, 1844, p. 239.—Idem, 1847, pp. 134, 135, Tav. xxi, fig. 110.—Neumann, 1897, pp. 414, 419.—Fuller, 1899, pp. 389–394, figs. 3.—Lounsbury, 1900, pp. 29–32, pl. iii, fig. 1.

1899: "*Rhicephalus decoloratus* Koch" of Fuller, 1899, p. 392 (misprint for *Rhipicephalus decoloratus*).

1901: *Boophilus decoloratus* (Koch) Stiles & Hassall, 1901, pp. 2, 3.—Salmon & Stiles, 1901, pp. 433–437, figs. 152, 153*c*, 154*d*, 155.

Habitat.—Cattle, horses, etc., Cape of Good Hope, Africa.

Historical review of Boophilus decoloratus.

This species was originally described by Koch (1844, p. 239) as follows:

Female.—Flat, oval, shining, ocher yellow, margin lighter all around; legs light yellow; length 1 line.

Male.—Unknown.

Habitat.—South Africa.[1]

In 1847 Koch repeated this diagnosis, to which he added the following description:

The outline more oval than egg-shaped, the border slightly raised, without distinct marginal groove on the hinder part; scutum shiny, with a groove on the sides, which unites with the curved grooves in front and back, and, as in several species, incloses a *rautenförmige* [= square, diamond-shaped, lozenge-shaped!] elevation. Capitulum short, broad, posterior margin straight anteriorly with a small groove each side of the insertion of the haustellum. Palpi small; legs as usual.

The entire body yellow dorsally, the *rautenförmige* elevation on the scutum with rust-reddish lines, capitulum and palpi darker yellow, both with brownish edges. Ventral surface and legs light yellow.

One specimen.[2]

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[1] *R. decoloratus.* Flach, oval, glänzend, ockergelb, der Rand rundum heller. Beine hellgelb. Länge 1'''. Weibchen.

Männchen: unbekannt.

Vaterland: Südafrika.

[2] *Rhipicephalus decoloratus.* Flach, oval, glänzend, ockergelb, der Rand heller, Beine hellgelb. Weibchen.

Männchen: unbekannt.

Länge 1'''.

Koch. Arch. f. Naturgesch. X. I., p. 239, n. 7.

Der Umriss mehr oval als eiförmig, der Rand ein wenig aufwärts erhöht, ohne deutliche Randfurche des Hinterleibes; der Kopfschild glänzend und auf diesem eine Furche über den Seiten, welche sich vorn und hinten mit den geschwungenen Furchen verbindet und wie bei mehreren Arten eine glänzende rautenförmige Beule einschliesst. Der Mundschild kurz, breit, hinten geradrandig, vorn beiderseits der Einfügung des Rüssels mit einem Grübchen. Die Taster klein; die Beine wie gewöhnlich.

Der ganze Körper oben gelb, die rautenförmigen Beulen auf dem Kopfschilde mit

This specimen, which is now in the Berlin Museum, was recently restudied by Neumann, who described it as follows:

Female.—Body flat, oval, a little convex at the sides, scarcely broader posteriorly than anteriorly; length, 2.2 mm.; breadth, 1.3 mm. Scutum longer than broad, rounded at the sides, with very superficial and very fine punctations, brilliant, yellow in its median portion, red on the sides, lateral of the anterior grooves; eyes red. Dorsal surface of the abdomen yellowish white, glabrous, redder in the middle, and, through its transparency, allowing the blackish ramifications of the intestines to be seen; lateral margin elevated, without marginal groove; posterior festoons slightly apparent. Ventral surface yellowish, with blackish spots [showing through] because of its transparency; anus reddish. Capitulum red, with a very short, broad base, the posterior angles barely projecting, the anterior and posterior margins equal, as also are the antero-lateral and postero-lateral margins. Palpi short, the second and third articles angular laterally. Legs rather short, yellowish white; coxæ contiguous; coxæ I with two short teeth, the others like the type; tarsi short, with two consecutive spurs; pulvillum short, barely attaining a third of the length of the claws.

Habitat.—South Africa.

This species is more closely related to *Rh. annulatus* than to any other, but insufficiently determined.[1]

Fuller (1899) has recently determined the Blue Tick of South Africa as identical with Koch's *Rh. decoloratus* (see above, p. 430); while Lounsbury (1900, pp. 29–32) accepts this determination as correct and gives the following account of its life habits:

The Blue Tick (*Rhipicephalus decoloratus* Koch).—This is the most abundant and the most widely distributed tick in the Colony. It takes its popular name from the color of the distended female, which is a displeasing bluish gray. The small size of this species, its almost colorless, slender legs, the color of the female, and a small but distinct tail-like projection from the body of the male are characters which serve for its ready separation from our other common ticks. The distended female measures

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roströthlichem Anstriche, Mundschild und Taster dunkler gelb, beide mit bräunlichen Kanten. Die Unterseite und die Beine hellgelb.

Ein Exemplar.

Vaterland: Südafrika.

[1] *Femelle.*—Corps plat, ovale, à côtés peu convexes, à peine plus large en arrière qu'en avant, long de 2mm2, large de 1mm3. *Ecusson* plus long que large, à côtés arrondis, à ponctuations très superficielles et très fines, brillant, jaune dans sa partie médiane, roux sur les côtés, en dehors des sillons antérieurs; yeux roux. *Face dorsale* de l'abdomen blanc jaunâtre, glabre, plus rousse dans le milieu, laissant apercevoir par transparence les ramifications noirâtres de l'intestin; bord latéral relevé, sans sillon marginal; festons postérieurs peu apparents. *Face ventrale* jaunâtre, à taches noirâtres par transparence; anus roussâtre. *Rostre* roux, à base très courte et large; les angles postérieurs à peine saillants, les bords antérieur et postérieur égaux entre eux, ainsi que les bords latéraux antérieurs et postérieurs. Palpes courts, le 2e et le 3e articles anguleux en dehors. Pattes plutôt courtes, blanc jaunâtre; hanches contiguës; celles de la 1re paire à deux dents courtes, les autres semblables au type; tarses courts, avec deux éperons consécutifs, caroncule courte, atteignant à peine le tiers de la longueur des ongles.—*Patrie*: Afrique méridionale.

D'après l'exemplaire de Koch, Afrique australe (Muséum de Berlin).

Espèce plus voisine de *Rh. annulatus* que de toute autre; mais insuffisamment déterminée.

about one-half inch in length by about one-third as wide. The male is brownish yellow, with dark markings; is only about an eighth of an inch in length, and, in common with the early stages of both sexes, escapes general notice. It is generally to be found beneath the distended female.

The Blue Tick is nearly related to the common cattle ticks found in Australia, North and South America, and in other parts of the world. Prof. G. Neumann, an eminent authority on ticks, considers that it should be connected with the American cattle tick (*Rhipicephalus annulatus* Say; *Boophilus bovis* Riley) as a variety, and he will probably classify it as such in a new work which he has in preparation.

Notes on the life cycle of the species were given in the Agricultural Journal for November 24, 1898, by Veterinary Surgeons Dixon and Spreull. I have reared several different lots on cattle and goats, but have not yet traced all the habits. The eggs to the number of several thousands are laid on or near the surface in grass stubble or similar shelter and the larvæ on hatching ascend the grass or bush, as in the other species studied. Two thousand two hundred and fifty larvæ have been counted at the top of a single blade of grass. By day and by night, through wind, rain, and light frost, they remain at their posts. Grass found infested and protected by a barrier of cut thorns was found to be still infested three months later, which shows that the young ticks may live at least this length of time on the veld. The female, after dropping from the host, starts laying in from five days to two weeks in summer, while in winter at Cape Town, at a temperature of 65° to 70°, she delays until the third or fourth week has passed. Similarly, the incubation period of the egg varies from three weeks to three months. At a temperature of 85° to 90° in the incubator hatched eggs have been obtained in four weeks from the dropping of the mother tick, which shows how heat hastens the development. Some moisture appears necessary during the incubation period, as several batches of eggs kept in dry boxes have shriveled and failed to hatch.

The Blue Tick molts twice, but remains on its host through both changes, thus differing materially in habit from the Bont, Bont Leg, Red, and other South African species; it, however, becomes motionless, and appears as if devoid of life before both molts. The larva begins to distend by the end of the second day of its attachment, and seems to cease enlarging in from three to three and one-half days. Two days later, under a magnifying glass, the body contents may be seen to have shrunk away from the skin back to the mouth organs. Finally this larval skin ruptures across the top in front, and the tick, now in the second, or nymph, stage, crawls out. This change has been observed to take place as early as six days from the attachment of the larva, and as late as the tenth. The nymph settles down near by and after a few days distends, just as did the larva. In appearance, it resembles the adult female, but its sides, in place of being parallel, converge slightly towards the rear. After the fifth day from the molt, no further enlargement is perceptible, and doubtless feeding has ceased. In another day or two the outlines of the adult are dimly distinguishable through the translucent skin, particularly across the front, and shortly thereafter there is a rupture as before, and the tick makes its appearance as the adult. The nymphic stage has about the same duration as the larval; in instances observed it has varied from seven to ten days. The two stages together in numerous cases occupied from fifteen to twenty days. The male is very similar to the female in size, color, and general appearance just after the molt, and, being small, one might be easily mistaken for the other when viewed by the unaided eye. The female settles down almost at once, and so, apparently, does the male; but the latter wanders much farther and is therefore not easily traced. After a day or two males are seen crawling about in the hair, evidently searching for mates. I am not certain how soon mating takes place after moulting, but my observations lead me to conjecture that both sexes feed for a short time, and that the male then lets go his hold and looks for a companion. However that may be, the females nearly all have mates by the fourth day.

Distention has begun by that time, and seems to proceed whether or not a male has come up; this is another point that needs confirmative observation. A few females observed have fallen in seven days, but the great majority have not fallen until after the ninth day, and some have remained until the eleventh. The male remains on the skin when his mate drops, but what becomes of him afterwards I have not observed.

The life period on the host for the female is thus from three to four and one-half weeks. No individual ticks that I have observed have, however, dropped in less than twenty-three days, and most remained for twenty-six. The entire life cycle may be passed in two summer months, but, in fact, probably seldom takes less than two and a half or three. There is a possibility of three broods a year in our Cape climate and a probability of at least two broods.

The life period on the animal during the winter months is not likely to be more than a day or two longer than in the summer, at least when dry weather is the rule in winter as it is in our eastern sections. Being hidden in the hair when young and pressed against the warm body of the animal, the tick is kept warm throughout its stay. Numerous nymphs and some larvæ, which I scraped off after they had ceased to feed, moulted when kept in glass tubes; but the change in some cases took over a week in place of the two or three days as it would have on the warm skin. Some of the adults obtained in this way were kept alive for twelve days in the tubes and were then placed in spirit; as they can thus do without food, it can not be necessary for them to settle down at once after molting on an animal.

BOOPHILUS OF DOUBTFUL SYSTEMATIC POSITION.

Besides the above-described forms, other ticks have been described which belong to *Boophilus*, but their exact status must be determined by a comparison of the specimens in question with the other forms. They will be mentioned here under the generic name (*Rhipicephalus*) under which they were described, rather than as *Boophilus*, in order to avoid unnecessarily increasing synonyms.

A.—HYPOSTOME WITH TEN ROWS OF DENTICLES. MALE WITH TAIL.

Rhipicephalus caudatus[1] (Neumann, 1897) Fuller, 1899.

(Figure 154*b*.)

Neumann proposed for certain ticks a new variety, under *Rhipicephalus annulatus*, naming it *Rh. annulatus caudatus*. It is apparent that the Japanese specimens were looked upon as types. He considered these identical with *Rh. microplus* Canestrini from Paraguay—under which circumstance the new name *caudatus* was not justified. Neumann's description reads:

> I include also in *Rhipicephalus annulatus*, with the rank of a variety (*Rh. annulatus caudatus*), a form which is represented in my collection by 23 females and 2 males

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[1] SYNONYMY AND BIBLIOGRAPHY.

1887: ? *Hæmaphysalis micropla* CANESTRINI (1887), p. 104, pl. IX, figs. 3–5. [See also CANESTRINI, 1890, p. 493, placed in *Rhipicephalus*.—NEUMANN, 1897, pp. 408, 413, as syn. of *Rhipicephalus annulatus caudatus*.]

1890: ? *Rhipicephalus microplus* (Canestrini) CANESTRINI, 1890, p. 493.

1897: *Rhipicephalus annulatus caudatus* NEUMANN, 1897, pp. 413, 414, fig. 42. [See also STILES & HASSALL, 1901, p. 3.]

1899: *Rhipicephalus caudatus* (Neumann) FULLER, 1899, pp. 390, 391.

collected from the horse in Miyasaki (Japan), and in that of the Museum of Paris by 250 females and 6 males from Mauritius, and probably taken from cattle (for the collection includes also 3 large gravid females of *Hyalomma ægyptium*); further, 22 females and 1 male from Cayenne (where the peculiar characteristics of the variety are only slightly marked). I also thus determine a male and a female originally from the Senegal (coll. A. Railliet), and a male collected in Borneo from the deer (coll. R. Blanchard). Finally, I consider as belonging to this variety *Hæmaphysalis micropla* Can., found in South Chaco (Paraguay), on an undetermined mammal (Canestrini), and under the bark of the trees in Rio-Apa (Paraguay), by A. Balzan. The variety is noticeable because of the strength of the chitinous portions and especially because of the caudiform appendage of the male. The essential characteristics are the following:

Female.—The projections on the posterior margin of coxæ I more marked, just outlined on pair II, less and less marked in the following pairs; in some cases (in the majority of specimens from Japan) five rows of denticles on each half of the hypostome.

Male.—Color darker. Eyes a little more distinct. Posterior margin of the body not festooned, but prolonged by a conical chitinous point in the direction of the median furrow, which ends a little in advance of the point, and is deeper [than that in the type]. Adanal shields more chitinous, dark brown, projecting. Teeth on the posterior margin of coxæ I much stronger. Hairs very much longer and very much more abundant.[1]

We have no specimens of this species and Canestrini's description is not accessible to us, hence we are not in a position to express a definite opinion concerning it. It may, however, be noted that a caudate form with eight rows of denticles on the hypostome (*Boophilus australis*) occurs in Venezuela and Argentina; also that Birula points out the resemblance of his *Rh. calcaratus*, which has eight rows of denticles, to Canestrini's *Rh. microplus*. The possibility of the specific identity of *Rh. microplus* and *Rh. australis* does not therefore appear to be excluded. Against such identity, however, may be quoted Canestrini's statement (1890, p. 493) that the scutum of the male covers the entire body. The validity of the Japanese species, with ten rows of teeth, appears not to be without foundation.

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[1] Je rattache aussi à *Rhipicephalus annulatus*, à titre de variété (*Rh. annulatus caudatus*), une forme qui est représentée dans ma collection par 23 femelles et 2 mâles recueillis sur le Cheval à Miyasaki (Japon), et dans celle du Muséum de Paris, par 250 femelles et 6 mâles provenant de l'Ile de France et probablement pris sur le Bœuf (car le lot comprend encore trois grosses femelles pleines de *Hyalomma ægyptium*), plus 22 femelles et 1 mâle provenant de Cayenne (où les particularités de la variété sont peu accentuées). Je dispose aussi d'un mâle et d'une femelle originaires du Sénégal (collection A. Railliet), et d'un mâle pris à Bornéo sur un Cerf (coll. R. Blanchard). Enfin, je considère comme appartenant à cette variété *Hæmaphysalis micropla* Can., trouvé au Chaco méridional (Paraguay), sur un Mammifère indéterminé (Canestrini), et sous l'écorce des arbres à Rio-Apa (Paraguay), par A. Balzan. La variété se fait remarquer par le renforcement des parties chitineuses et surtout l'appendice caudiforme du mâle. Les particularités essentielles sont les suivantes:

Femelle.—Saillies du bord postérieur des hanches de la première paire mieux marquées, esquissées à la deuxième paire, de moins en moins aux suivantes; parfois (dans la plupart des spécimens du Japon), cinq files de dents sur chaque moitié de l'hypostome.

Mâle.—Teinte plus foncée. Yeux un peu plus apparents. Bord postérieur du corps non festonné, mais prolongé par une pointe conique, chitineuse, dans la direction du sillon médian, qui s'arrête un peu en avant d'elle et est plus profond. Ecussons adanaux plus chitineux, brun foncé, saillants. Dents du bord postérieur des hanches de la première paire bien plus fortes. Poils bien plus longs et bien plus abondants.

B.—EIGHT ROWS OF DENTICLES ON HYPOSTOME. MALE APPARENTLY WITHOUT TAIL, SIMILAR TO B. ANNULATUS.

The North African cattle tick.[1]

Mégnin (1880) determined as identical with *Ixodes Dugesii* Gervais, 1844, a species of tick from North Africa. Curtice (1892) pointed out the resemblance of this North African form to the North American species, and he and Neumann considered them specifically identical. This view is strongly supported by the description given by Mégnin, and from present knowledge it appears impossible to show good characters which would separate the two forms. At the same time we prefer to await further detailed comparison of specimens before either agreeing or disagreeing with Curtice and Neumann on this point. Mégnin's description reads as follows:

> *Characters common to both sexes.*—Capitulum small and slightly salient, 0.60 mm. long, in shape of a blunt, very elliptical cone; palpi short, 0.30 mm. long, slightly shorter than the hypostome, slightly valvate, articles very distinct, the first one short, cylindrical, the two following irregularly polyhedric, the last small, cylindrical, infero-terminal; hypostome a little spatulate, with rounded extremity, and with eight rows of teeth, equal in each row; mandibles sliding each in a rough-skinned sheath, and terminated by an articulated harpoon, with four teeth in two groups, the two teeth of the lower group being larger than those of the terminal group. Legs six-jointed, coxæ oval, placated on the tegument, separated in the female, contiguous in the male; articles uniformly brown; tarsi cylindro-conical, with extremity dentated inferiorly in the two sexes, first pair mono-dentate, the others bidentate; terminated by an ambulacrum, the claws of which are twice as long as the pulvillum.
>
> *Fertilized female, young.*—Six millimeters long, 2.50 mm. broad; body a pale red color, flattened, elongate, narrowed posteriorily, without festoons, presenting above and below the same furrows found in the females of other species. Scutum 1.20 mm. long, 1 mm. broad, rectangulo-pentagonal, narrow and short, with parallel lateral sides, posterior angle rounded, and with sinuous sides of a dull, chagrinous, brown-black color, strongly excavate in front, and in a square, for the articulation with the capitulum; eyes at the external and posterior angles of the scutum. Vulval pore and cutaneous striæ the same as in all females of *Ixodes*.
>
> *Fertilized female, replete.*—Fourteen millimeters long, 8 mm. broad, body thick,

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[1] SYNONYMY AND BIBLIOGRAPHY.

1880: "*Ixodes Dugesii* Gervais, 1844," of MÉGNIN, 1880, pp. 126, 127, fig. 44b.—NEUMANN, 1888, pp. 92, 93.—IDEM, 1892a, pp. 97, 98.—IDEM, 1892b, pp. 100, 101. [Given as syn. of *Boophilus bovis* by CURTICE, 1891a, p. 318.—IDEM, 1891b, p. 685.—IDEM, 1892c, pp. 243, 244.—MARX, 1892, p. 236.—OSBORN, 1896, p. 257.—MORGAN, 1899, p. 139.] [See also NEUMANN, 1897, p. 408, as syn. of *Rhipicephalus annulatus*.]

1894: "*Ixodes Dugesi* Gervais" of DOLLY, 1894, p. 1000, as syn. of *Boophilus bovis*.

elongate, slightly flattened, similar to a bean without the hilus, which would have parallel sides of a deep lead color, with longitudinal grooves or impressions similar to preceding species [*I. ægyptius, I. algeriensis*], but less pronounced.

Male.—Three and five-tenths millimeters long, 2.50 mm. broad, body subtriangular, angles and sides rounded, especially posteriorly. Scutum covering entire superior surface without leaving lateral clear margin; of a deep brown color, smooth, brilliant, and festooned posteriorly, each interval between the festoons being continued dorsally by a longitudinal sillon extending to the posterior quarter of the shield. Eyes simple, on the edge of the shield at the height of the second pair of legs. Ventral tegument pale, presenting on each side of the anus two pairs of arched chitinous plaques, of a deep-red color, narrow and equal. Genital pore round, chitinous, back of capitulum, at the height of legs II.

Nymph.—One to four millimeters long, 0.80 to 2.50 mm. broad; body oval; scutum, capitulum, and legs same size and form as in the larva, but having one pair of legs more, all darker color; stigmata present, no genital organs.

Larva.—Five-tenths of a millimeter long, 0.4 mm. broad, body flat, of orbicular form, slightly angular in front, color pale red, abdomen lighter; scutum cordiform, broad and short; capitulum similar to that of the adult, but smaller in every respect; legs shorter and more slender, tarsi not dentate. Genital organs, and respiratory stigmata absent.

Egg.—Fifty one-hundredths of a millimeter long, 0.40 mm. broad, ovoid, of deep yellow color, smooth, shining.[1]

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[1] *Caractères communs aux deux sexes.*—*Rostre* petit et peu saillant long de 0^{mm},60, en cône mousse très surbaissé; *palpes maxillaires* courts, longs de 0^{mm},30, un peu moins long que le dard maxillo-labial, peu valvés, à articles très distinct (fig. 44, B), le premier court, cylindrique, les deux suivants polyédriques irréguliers, le dernier petit, cylindrique, inféro-terminal; *dard maxillo-labial* un peu spatuliforme, à extrémité arrondie, à huit rangs de dents égales dans chaque rangée; mandibules glissant chacune dans une gaîne chagrinée, terminée par un harpon articulé à quatre dents en deux groupes, les deux du groupe inférieur plus grandes que celles du groupe terminal. Pattes à six articles, à hanches ovalaires plaquées sur le tégument, distantes chez la femelle, contiguës chez le mâle; articles uniformément bruns; tarses cylindro-coniques, à extrémité dentée inférieurement chez les deux sexes, mono-dentée à la première paire, bi-dentées dans les suivantes; terminée par un ambulacre dont les crochets dépassent de moitié la caroncule.

Femelle fécondée, à jeun.—Longue de 6^{mm}, large de 2^{mm},50; corps de couleur roux pâle, aplati, allongé, rétréci postérieurement sans trace de festons, présentant en dessus et en dessous les mêmes sillons déjà constatés chez les femelles des autres espèces. *Écusson* long de 1^{mm},20, large de 1^{mm}, rectangulo-pentagonal, étroit et court à côtés latéraux parallèles, à angle postérieur arrondi et à côtés sinueux, d'une couleur brun-noire mate chagrinée, fortement échancré en avant et en carré pour s'articuler avec le rostre; yeux aux angles externes et postérieurs de l'écusson. Pore vulvaire et stries cutanées, comme chez toutes les femelles d'Ixodes.

Femelle fécondée, repue.—Longue de 14^{mm}, large de 8^{mm}, corps épais, allongé, un peu aplati, semblance à un haricot sans hile qui aurait les côtés parallèles, de couleur plombée foncée, avec des [p. 127] sillons ou impressions longitudinales comme dans les premières espèces mais moins prononcés.

Mâle.—Long de 3^{mm},50, large de 2^{mm},50, à corps subtriangulaire, à angles et côtés arrondis, surtout postérieurement. Écusson recouvrant toute la face supérieure sans laisser de marge claire latéralement, de couleur brune foncée, lisse, brillant, et festonné postérieurement, chaque intervalle de feston se continuant supérieurement par un sillon longitudinal s'éteignant au quart postérieur de l'écusson. Yeux simples au bord de l'écusson à la hauteur de la deuxième paire de pattes. Téguments infé-

Rhipicephalus calcaratus[1] from Caucasus.

(Figures 156–166.)

Birula examined some ticks collected in Transcaucasus, Occidental Caucasus, and Ciscaucasus, which he described originally as *Ixodes calcaratus*. The original description is not accessible to us. Later (1895) he described them in detail, giving the following diagnosis and the figures here reproduced:

Brownish red or yellowish brick color. Body elongate oval. Capitulum hexagonal, very broad. Eyes distinct, elliptical. Palpi very short, conical. Rostrum [hypostome] armed with 8 rows of teeth. Legs calcarate. Coxæ I bidentate. Dorsal porose warts [areas] small. Genital pore situated between coxæ I (♀) or II (♂). Stigmate areas subrotund, small. Male provided with four anal shields [clypei].

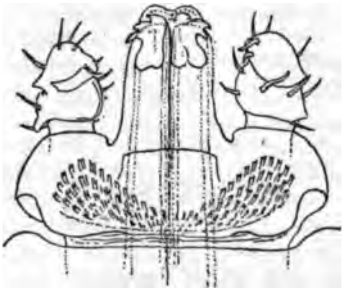

FIG. 156.—Capitulum of female *R. calcaratus*. After Birula, 1895, fig. 10.

Body of the female, if replete, elongate oval, posterior portion back of spiracles narrower, sides of the anterior portion constricted four times at the legs and also at the spiracles, two poriferous dorsal rotund warts [areas] very small. Dorsal shield (scutum) provided with eyes, dispersely setulose, subpentagonal, length almost double the width, anterior angles slightly prominent, rotund, sides of the anterior portion of the scutum subparallel, posterior portion behind the eyes triangular, apex rounded, scarcely longer than the anterior part. Eyes elliptical, slightly convex, protruding very slightly from the edge of the

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rieurs pâles, présentant de chaque côté de l'anus deux paires de plaques chitineuses arquées, de couleur roux foncé, étroites et égales. Pore génital rond, chitineux, en arrière du rostre à la hauteur de la deuxième paire de pattes.

Nymphe.—Longue de 1 à 4^{mm}, large de $0^{mm},80$, à $2^{mm},50$; corps ovale, à écusson, rostre et pattes de même volume et de même forme que chez la larve mais ayant une paire de pattes de plus que celle-ci; le tout plus foncé; pas d'organes génitaux, mais des stigmates.

Larve.—Longue de $0^{mm},50$, large de $0^{mm},40$, corps aplati de forme orbiculaire, un peu anguleux en avant, de couleur roux pâle, l'abdomen plus clair; écusson cordiforme large et court; rostre semblable à celui des adultes, mais plus petit en tous sens; pattes plus courtes et plus grêles, à tarse non denté. Pas d'organes génitaux, ni de stigmates respiratoires.

Œuf.—Long de $0^{mm},50$, large de $0^{mm},40$, ovoïde, de couleur fauve foncée, lisse, luisant.

Habitat.—Nous avons recueilli cet Ixode en abondance sur des moutons barbaresques et touaregs, et sur des bœufs d'Algérie et du Maroc amenés à l'abattoir militaire de Vincennes. Nous l'avons aussi recueilli sur des bœufs sardes et sur des bœufs auvergnats. Les deux sexes s'y trouvaient fréquemment accouplés et quelques nymphes y étaient mélangées aux adultes.

[1] SYNONYMY AND BIBLIOGRAPHY.

(?): *Ixodes calcaratus* BIRULA (Russian article not accessible).—Travaux de la Soc. de Natur. de St. Petersbourg, XXIV, l. 2, p. 137 (not accessible).

1895: *Rhipicephalus calcaratus* (Birula) BIRULA, 1895, pp. 361–363, Tav. II, figs. 10–20. [See also NEUMANN, 1897, p. 408, as syn. of *Rhipicephalus annulatus*.]

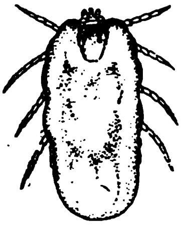
FIG. 157.—Dorsal view of female *R. calcaratus*. After Birula, 1895, fig. 11.

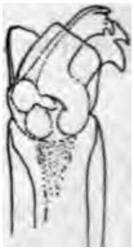
FIG. 158.—End of mandible of female *R. calcaratus*. After Birula, 1895, fig. 12.

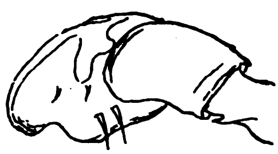
FIG. 159.—Coxa I of female *R. calcaratus*. After Birula, 1895, fig. 13.

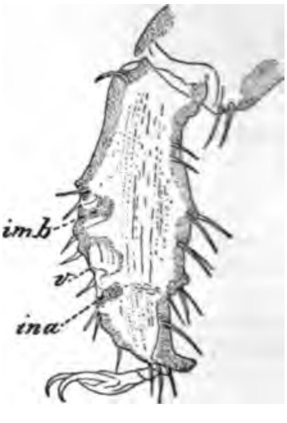

FIG. 160.—Tarsus I of female *R. calcaratus*: *v*, auditory vesicle; *imb*, basal chitinous callum; *ina*, apical chitinous callum. After Birula, 1895, fig. 14.

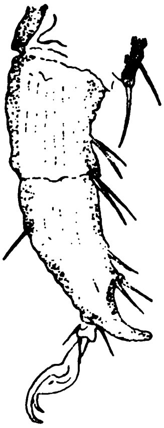
FIG. 161.—Tarsus IV of female *R. calcaratus*. After Birula, 1895, fig. 15.

shield, facing outward. *Capitulum* short and broad (almost twice as broad as long), frontal portion hexagonal, lateral angles very prominent, postero-lateral margins perceptibly emarginate; margins, anterior nearly straight, posterior arched; posterior portion of the capitulum constricted like a neck, equal in length to the frontal portion; ventrally the posterior margin of the capitulum is almost semicircular, no posterior angles, situated in the anterior emargination of the breast. Frontal areas densely porose, ovate, moderately large, placed obliquely on the posterior superficial portion of the capitulum. Palpi and rostrum [haustellum] attaining almost the length of the frontal portion of the head. *Rostrum* [haustellum] slightly longer than the palpi, broad and short, incised at the apex, no apical granulated portion, teeth [denticles] rhomboidal, obtuse, 8 rows (9–10 denticulate series not attaining the base). Hooks of the mandibles: Narrower ones bidentate, broader ones bidentate or tridentate. Palpi very short, subconical, spiniferous; first article very small, hidden under the anterior margin of the capitulum; second article pedunculate, in the dilated part a sharp transverse ridge, drawn out in an angle at the external margin, provided with an internal dilated margin, anterior portion dilated, armed beneath on the internal margin with several short and very strong spines; third article smaller than the preceding, subtriangular, internal margin rounded, spiniferous, arched posteriorly, external angles acute. Legs short, subequal, first tarsi unicalcarate, the others bicalcarate (the apical spur being twice as long and strong), robust and long spines located on the internal margin. First coxæ subtriangular, sparsely setose above, provided on the posterior margin with two very short blunt teeth (rounded at the apex); coxæ II and III elongate rotund, posterior margin incised; coxa IV subquadrate, with angles rounded or nearly elongate-rotund. Auditory vesicle of the I tarsi ovate, with distinct internal hairs; proximal and distal of the vesicle the external margin is provided with chitinous indurations, of which the distal (apical) seen from the side of the tarsus is smaller, conical, the apex scarcely dilated, the proximal (basal) is pedunculate (the pedicle being short and thick) and provided with a head at the apex. Genital pore very small, situated between and a little below the I coxæ. Anal valve provided on both sides with four spines, arranged in a triangle. Spiracle areas very small, one-half as large as the posterior coxæ, elliptical. Length of body, 6.5 mm. (♀ replete); width, 3.5 mm.; length of I leg, 2 mm.; length of II leg, 2.5 mm.

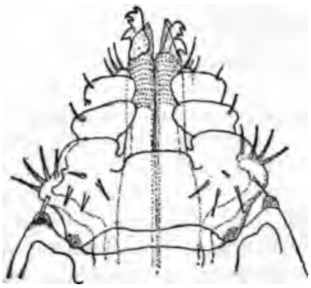

Fig. 162.—Dorsal view, capitulum of male *R. calcaratus*. After Birula, 1895, fig. 16.

Male similar in size and color to the nonreplete female, but dorsal shield provided with five constrictions above the legs and spiracle areas, anterior angles very prominent, and dentiferous; two external teeth (of which the superior is broader and half as long as the inferior), the internal single and small. Capitulum of the male slightly narrower and longer than in the female, provided with spiniferous angles on each side and an arched posterior margin. Palpi perceptibly shorter than the rostrum [haustellum]. Posterior margin of the body 7-lobed; all lobes rounded, by no means broad, especially median lobes narrower; ventral surface of the abdomen provided on each side of the anus with two shields, the median of which are larger, elongate, increasing in size posteriorly, but with narrower apex, which is obliquely abrupt toward the exterior; external angle rounded, internal angle prominent, posterior margin biincised, setiferous, provided with several apical tubercles; lateral shields smaller, elongate-triangular. Legs short, rather thick, setiferous; tarsi I unicalcarate, others armed with two subequal spurs; coxæ I subtriangular, decidedly narrower at the internal margin, posterior margin provided with two teeth (the inner smaller), and between these a rather deep incision, the surface and exterior angles setiferous; coxæ II subquadrangular, postero-internal angle more or less prominent; coxæ III and IV subquadrangular, angles rounded. Genital pore rather wide, situated between the second pair of coxæ. Otherwise like the female. Length of body, 2.5 mm.

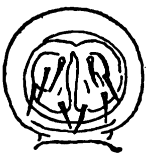

Fig. 163.—Anus of male *R. calcaratus*. After Birula, 1895, fig. 17.

It is very closely related to "*Rhipicephalo* (*Hæmaphysali*) *microplæ* (Canestrini)," but differs from it in having shorter legs, lobed posterior margin of the body, and bidentate coxæ; moreover, it inhabits other geographical regions.[1]

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[1] [p. 361] Brunneo-rufus vel fulvo-testaceus. Corpus elongato-ovale. Capitulum hexagonale, latissimum. Oculi distincti, elliptici. Palpi brevissimi, coniformes. Rostrum dentibus 8-seriatis armatum. Pedes calcarati. Coxæ I bidentatæ. Verrucæ dorsales porosæ [p. 362] parvæ. Rima genitalis inter coxas I (♀), vel II (♂), posita. Areolæ stigmaticæ subrotundæ, parvæ. Mas clypeis pygealibus quattuor auctus.

Feminæ corpus, si repletum, elongato-ovale, parte postica pone spiracula angustiore, partis anticæ lateribus ad pedes nec non ad spiracula quater coarctatis, verrucis poriferis dorsalibus duabus rotundis minimis. *Scutum dorsale* oculiferum, disperse setulosum, subpentagonum, latitudine fere duplo longius, angulis anticis parum prominentibus, rotundatis, lateribus partis scutuli anticæ subparallelis, parte postica pone oculos triangulari, apice rotundata, quam pars antica haud longiore. *Oculi* elliptici, parum convexi, a margine scuti vix distantes, extrorsum spectantes. *Capitulum* breve ac latum (longitudine fere duplo latius), parte frontali hexagonali, angulis lateralibus valde prominentibus, marginibus postico-lateralibus sensim emarginatis, marginibus antico subrecto, postico arcuato; capituli parte postica colliformiter coarctata, longitudini partis frontalis æquali; subtus margine capituli postico fere semicirculari, angulis posticis nullis, in sterni emarginatura antica sito. *Areæ frontales* crasse porosæ, ovatæ, sat magnæ, in capituli superficie postica oblique dispositæ. *Palpi rostrumque* longitudinem partis frontalis capituli fere attingentes. *Rostrum* palpis paulo longius, latum ac breve, apice incisum, parte granulata apicali nulla, dentibus rhomboidalibus

Neumann (1897) considered this species identical with the North American form. In this he may be correct, but we prefer to await a comparison of specimens before accepting the determination as definite. Certain characters mentioned by Birula appear to us to render Neumann's opinion at least debatable.

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obtusis 8-seriatis (seriebus 9–10 denticulatis basin non attingentibus). *Mandibularum unci* angustiores bidentati, latiores bi-vel tridentati. *Palpi* brevissimi, subconiformes, spiniferi; articulis I minimis, sub margine capituli antico latentibus; secundis pedunculatis, in parte dilatata crista acuta transversa, ad marginem externum anguliformiter producta, instructis margineque interno dilatato præditis, parte antica dilatata, subtus in margine interno spinis nonnullis valde robustis brevibusque armata; tertiis articulis præcedentibus minoribus, subtriangularibus, margine interno rotundato, spinifero, postico arcuato, angulis externis acutis. *Pedes* breves subæquales, tarsis I unicalcaratis, ceteris calcaribus duobus (quorum calcar apicale duplo longius et robustius) armatis, margine interno spinis robustis ac longis obsitis. *Coxæ* I subtriangulares, superne sparsim setosæ, margine postico dentibus duobus brevissimis, apice rotundatis, præditæ; coxæ II et III elongato-rotundatæ margine postico inciso; coxæ IV subquadratæ, angulis rotundatis, vel fere elongato-rotundatæ. Tarsorum I *vesica auditiva* ovata, pilis internis distinctis; ante ac pone vesicam margine externo callis chitineis prædito, quorum apicali (anticum), a latere tarsi visu, minore, coniformi, apice vix dilatato, basali (posticum) pedunculato (pedunculo brevi ac crasso) et ad apicem capitato. *Rima genitalis* minima, inter (et paulo inferius) coxas I posita. *Valva analis* utraque spinis 4 triangulariter [p. 363] dispositis instructa. *Spiraculorum areola* minima (coxis posticis duplo minor), elliptica.

Long. corporis = 6½ mm. (♀ repletæ).
Latit. corporis = 3½ mm.
Long. pedum I = 2 mm.
Long. pedum II = 2½ mm.

Mas *corporis statura* coloreque feminæ non repletæ similis, sed *scuto dorsali* coarctationibus quinque supra pedes ac areolas prædito, angulis anticis valde prominentibus, dentiferis: dentibus externis duobus (quorum dens superior latior ac dente inferiore duplo brevior), interno singulo ac parvo. *Capitulum maris* paulo angustius ac longius quam in femina, utrinque angulis spiniferis et margine postico arcuato ornatum. *Palpi* rostro evidenter breviores. Corporis *margo posticus* 7-lobatus: lobis omnibus rotundatis, haud latis, preterea lobis mediis angustioribus; abdominis superficies inferior ad anum utrinque clypeis pygealibus duobus prædita, quorum medii—majores, elongati, retrorsum gradatim dilatati, sed apice angustiore et oblique ad externum abrupto, angulo externo rotundato, interno prominente, margine postico bis inciso, setifero, tuberculis nonnullis apicalibus prædito; clypei laterales minores, elongato-triangulares. *Pedes* breves sat crassi, setiferi; tarsis I unicalcaratis, ceteris calcaribus duobus subæqualibus armatis; coxis I subtriangularibus ad marginem internum conspicue angustioribus, margine postico dentibus duobus (interno minore) et inter hos incisura sat profunda prædito, superficie et angulis externis setiferis; coxis II subquadrangularibus, angulo interno postico plus minusve prominente, coxis III et IV subquadrangularibus, angulis rotundatis. *Rima genitalis* sat lata, inter coxas II posita.

Ceterum ut in femina.

Long. corporis = 2½ mm.

Rhipicephalo (*Hæmaphysali*) *microplæ* (Canestrini) valde affinis, sed pedibus brevioribus, corporis margine postico lobato coxisque bidentatis differt, præterea alias regiones geographicas incolat.

C.—SIX ROWS OF DENTICLES ON HYPOSTOME.

Rhipicephalus annulatus, var. from Buenos Aires.

Neumann (1897, p. 413) has mentioned a tick from Buenos Aires which is apparently closely related to, if not identical with, *Boophilus decoloratus*, agreeing with that form in possessing three rows of denticles on each half of the hypostome. Neumann says:

> *Varieties.*—One variety, insufficiently characterized because the male is lacking, is distinguished from the type only by the presence of three rows of denticles on each half of the hypostome. It is represented in the collection of the Museum of Hamburg by 59 replete females, brown red, from 6 to 10 mm. in length, from Buenos Aires.[1]

D.—NUMBER OF ROWS OF TEETH ON HYPOSTOME (?) MALE APPARENTLY WITHOUT TAIL.

Hæmaphysalis rosea,[2] from the West Indies.

(Figures 167,168.)

In 1844, Koch described a West Indian tick as a new species, *H. rosea*. Curtice and Neumann have expressed the opinion that this is identical with the North American form, *Boophilus annulatus*. Possibly they are correct in this view, but a positive opinion on the subject can not be given. Koch's (1844, p. 237) original description reads:

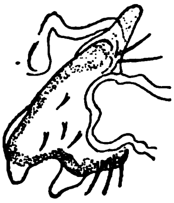

FIG. 164.—Coxa I of male *R. calcaratus*. After Birula, 1895, fig. 18.

> *Hæmaphysalis rosea: Male.*—Oval, posteriorly somewhat narrow, very shining, indistinctly very finely punctate, posteriorly three longitudinal grooves side by side, yellow red, almost rose red. Legs yellow. Length seven-eighths line.
>
> *Female.*—Thorax elongate, blood red, anteriorly in middle field a fiery red spot; replete body very large, with the same longitudinal grooves, reddish olive color. Legs somewhat darker yellow. Length $2\frac{3}{4}$ lines.
>
> *Habitat.*—West Indies.[3]

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[1] *Variétés.*—Une variété, insuffisamment caractérisée par défaut de mâle, ne se distingue du type que par la présence de trois files de dents sur chaque moitié de l'hypostome. Elle est représentée dans la collection du Muséum de Hambourg par 59 femelles repues, brun rouge, de 6 à 10 millimètres de longueur et provenant de Buenos Aires.

[2] SYNONYMY AND BIBLIOGRAPHY.

1844: *Hæmaphysalis rosea* KOCH, 1844, p. 237; type locality, West Indies.—IDEM, 1847, pp. 25, 121, 122, Tav. XXVI, figs. 95, 96.—MURRAY, 1877, p. 200, figs. 2. [Given as syn. of *Boophilus bovis* by CURTICE, 1891a, p. 318.—IDEM, 1891b, p. 685.—IDEM, 1892c, p. 243.—MARX, 1892, p. 236.—DOLLY, 1894, p. 997.—OSBORN, 1896, p. 257.—MORGAN, 1899, p. 139.] [See also NEUMANN, 1897, p. 408, as syn. of *Rhipicephalus annulatus*.]

[3] *H. rosea.* Eiförmig, hinten etwas schmal, sehr glänzend, undeutlich sehr fein gepünktelt, hinten drei Längsgruben nebeneinander, gelbroth, fast rosenroth. Beine gelb. Länge $\frac{7}{8}$ '''. Männchen.

Thorax länglich, blutroth, vorn im Mittelfelde ein Fleck feuerroth, Hinterleib vollgesogen sehr gross, mit denselben Längsgruben, röthlich-olivenfarbig. Beine etwas dunkler gelb. Länge $2\frac{3}{4}$ '''. Weibchen.

Vaterland: Westindien.

In his more extensive paper, published three years later, Koch (1847, p. 121) again refers to this form, giving two illustrations (copied as figs. 167, 168, in this paper), together with the following diagnosis and description:

Male.—Oval, very shining, posteriorly with three longitudinal grooves; yellow red; mouth shield [capitulum] reddish; palpi and legs yellow.

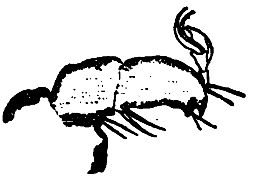

FIG. 165.—Tarsus IV of male *R. calcaratus*. After Birula, 1895, fig. 19.

Female.—Head shield [scutum] elongate, blood red, anteriorly in the middle field a fiery red spot; mouth shield [capitulum], palpi, and legs as in the male; body very large, fallen in dorsally, with the same three longitudinal grooves.

Length of male seven-eighths line, of replete female 2¼ to 2¾ lines.

The outline of the male tick is quite oval, still somewhat narrow posteriorly and on the posterior margin somewhat bluntly round; the surface is very finely, indistinctly, almost somewhat wrinkly punctate and very shining; in front of posterior margin are found three longitudinal grooves, of which the middle one is longer than the lateral and gutter shaped; anterior of this in the middle, two depressions and a shallow depression back of each of the two very fine small curved grooves of the indistinct head shield [scutum]. Mouth shield [capitulum] and palpi are small, the legs moderately long.

The color of the body is a brownish yellow red, bordering on the menning-red, darker in the middle of the back than on the sides. The mouth shield [capitulum] is lighter, reddish yellow. Palpi and legs are yellow. The replete female is broader anteriorly than posteriorly, rounded posteriorly, the outline being quite that of the sole of a shoe, on the back somewhat flat and almost fallen in, so that the lateral margins are perceptibly raised above the surface; the longitudinal grooves remain quite the same as in the male. The head shield [scutum] is narrow; elongate heart-shaped, convex, pin-point finely punctate, blood red, almost dark-varnish red, with a fire-red spot anteriorly on the middle field merging into the ground color. The body is reddish olive color. Mouth shield [capitulum], palpi, and legs are yellow, the latter somewhat darker than in the male.

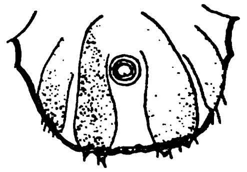

FIG. 166.—Ventral view posterior portion of male *R. calcaratus*. After Birula, 1895, fig. 20.

Three specimens, a male and two females, both the latter replete.

Habitat.—West Indies.[1]

It will be noticed that Koch gives neither the host nor the exact type locality.

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[1] Eiförmig, sehr glänzend, hinten mit drei Längsgruben; gelbroth; Mundschild röthlich; Taster und Beine gelb. Männchen.

Kopfschild länglich, blutroth, vorn im Mittelfelde ein Fleck feuerroth; Mundschild, Taster und Beine wie oben; Hinterleib sehr gross, auf dem Rücken eingefallen, mit denselben drei Längsgruben. Weibchen.

Länge des Männchens ⅞''', des vollgesognen Weibchens 2¼ bis 2¾'''.

Koch. Arch. f. Naturgesch. X. I. p. 237. n. 1.

Dem Umrisse nach ist die männliche Zecke ziemlich eiförmig, doch hinten etwas schmal und am Hinterrande [p. 122] etwas stumpf rund; die Fläche ist sehr fein, undeutlich, fast etwas runzelig punktirt und sehr glänzend; vor dem Hinterrande befinden sich drei Längsgruben, davon die mittlere länger als die äussern und rinnen-

GENUS DERMACENTOR[1] Koch, 1844.

GENERIC DIAGNOSIS.—*Ixodidæ. Rhipicephalinæ:* Eyes present. Base of capitulum rectangular; broader than long. Dorso-submedian porose plates present. Palpi short and thick. Stigmal plate comma-shaped; short. Male without anal shields. Coxæ I bidentate in both sexes; coxæ IV of male much larger than I to III. Scutum usually ornamented.

TYPE SPECIES.—*Dermacentor reticulatus* (Fabricius, 1794.)

Neumann's key to the species of this genus appears to us somewhat difficult to use and likely to lead one astray in determinations. As only four species are at our disposal at present, and two of these may perhaps be specifically identical, we refrain from an attempt to revise the entire key.

KEY TO FOUR AMERICAN SPECIES OF THE GENUS DERMACENTOR.

[For forms reported in the United States, follow Roman type.]

1. Stigmal plate finely punctate .... *D. electus*, p. 455
   Stigmal plate coarsely punctate 2
   Stigmal plate with 8 to 40 large circular structures (figs. 215, 217), *each surrounded by fine punctations.* Porto Rico, *on horses* .... *D. nitens.*
2. Parasitic on cattle .... *D. reticulatus*, p. 448
   Parasitic on the wapiti .... *D. variegatus*, p. 452

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förmig, vor dieser, auf der Mitte, zwei Eindrücke, und ein seichter Eindruck hinter jedem der zwei sehr feinen Curvengrübchen des undeutlichen Kopfschildes. Mundschild und Taster sind klein, die Beine mässig lang.

Die Körperfarbe ist ein bräunliches Gelbroth, sich dem Mennigrothen nähernd, auf der Mitte des Rückens dunkler als an den Seiten. Der Mund ist heller, röthlichgelb. Die Taster und Beine sind gelb. Das vollgesogene Weibchen ist vorn breiter als hinten, am Hinterrande gerundet, dem Umrisse nach ziemlich schuhsohlenförmig, auf dem Rücken etwas flach und fast eingefallen, so dass die Seitenränder sich merklich über die Fläche erheben; die Längsgruben bleiben ziemlich dieselben wie bei dem Männchen. Der Kopfschild ist schmal; länglich herzförmig, gewölbt, nadelrissig fein punktirt, blutroth, fast dunkellackroth, mit einem feuerrothen, in die Grundfarbe übergehenden Fleck vorn auf dem Mittelfelde. Der Körper ist röthlicholivenfarbig. Mundschild, Taster und Beine sind gelb, letztere etwas dunkler als beim Männchen.

Drei Exemplare, ein Männchen und zwei Weibchen, beide letztere vollgesogen.
Vaterland: Westindien.

[1] SYNONYMY AND BIBLIOGRAPHY.

1844: *Dermacentor* KOCH, 1844, pp. 235–237.—IDEM, 1847, pp. 24, 25, 109–121.—FÜRSTENBERG, 1861, p. 208.—MURRAY, 1877, pp. 187, 199.—CANESTRINI, 1890, pp. 483, 487, 488, 489, 490, 491, 493, 519–523.—IDEM, 1892, p. 581.—MARX, 1892, pp. 233, 236.—RAILLIET, 1893, pp. 713, 714.—OSBORN, 1896, p. 261.—OUDEMANS, 1896, p. 191.—NEUMANN, 1897, pp. 325, 326, 360–384.—MORGAN, 1899, p. 139.—WARD, 1900a, pp. 200, 201.—IDEM, 1900b, p. 436.—SALMON & STILES, 1901, pp. 447–456.

1882: *Pseudixodes* HALLER, 1882, pp. 311, 312 (type, *holsatus*). [See also CANESTRINI, 1890, p. 485.—NEUMANN, 1897, p. 360, as syn. of *Dermacentor.*]

1894: "*Dermacenter*" of FRANCIS, 1894, p. 451 (misprint for *Dermacentor*).

1899: "*Dermocenter*" of LEWIS, 1899, p. 3 (misprint for *Dermacentor*).

Neumann's key is here added, as it contains other forms:

KEY TO THE SPECIES OF THE GENUS DERMACENTOR.[1]

[For forms reported in the United States, follow Roman type.]

Females 1
Males 5

A.—Female.

1. Scutum marked with white spots 2
Scutum marked with red or yellow spots 4
Scutum not marked with light spots, blackish (Porto Rico) .... ***D. nitens.***
2. Scutum nearly as broad as long; second palpal article with dorsal retrograde prolongation .... *D.* ***reticulatus***, p. 448
Scutum longer than broad; second palpal article without prominent dorsal retrograde prolongations 3
3. Body oval; hairs few .... *D.* ***electus***, p. 455
Body oblong; hairs abundant .... *D.* ***variegatus***, p. 452
4. *Scutum nearly covered with light spots* (Africa) .... ***D. rhinocerotis.***
Scutum with three spots arranged in a triangle (Congo) .... ***D. circumguttatus.***

B.—Male.

5. Scutum marked with white spots 6
Scutum marked with red or yellow spots 8
Scutum of uniform color, without spots 9
6. Second palpal article very much swollen laterally, with dorsal retrograde spine .... *D.* ***reticulatus***, p. 448
Second palpal article slightly swollen laterally, without dorsal retrograde spine 7
7. Body oval .... *D.* ***electus***, p. 455
Body triangular .... *D.* ***variegatus***, p. 452
8. *Spots on scutum symmetrical; one large arrow-shaped spot anteriorly, representing a pseudo-scutum* (Africa) .... ***D. rhinocerotis.***
Four pairs of symmetrically arranged spots on scutum; pseudo-scutum absent (Congo) .... ***D. circumguttatus.***
9. *Scutum pubescent; palpi not swollen* (Porto Rico) .... ***D. nitens.***
Scutum glabrous; palpi swollen laterally (Syria) .... ***D. parvus.***

THE NET TICK (*Dermacentor reticulatus*).[2]

(Figures 61, 169–177.)

SPECIFIC DIAGNOSIS.—*Dermacentor:* Stigmal plate coarsely punctate.

Male.—Body same form and dimensions as young female, occasionally larger. Scutum deep reddish brown, but concealed for the most part by a silver white

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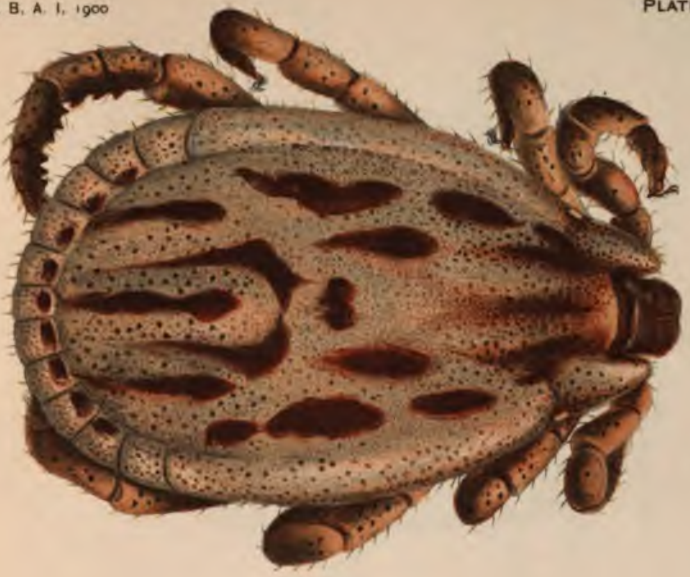
[1] The following species are not included in this key: *D. puncticollis, dentipes, clathratus, parabolicus, cruentus;* all Koch, none American. *D. planus* Rudenow. *D. Feai, auratus, indicus, longipes* Supino; apparently not American.

[2] SYNONYMY AND BIBLIOGRAPHY.

1794: *Acarus reticulatus* FABRICIUS, 1794, p. 428. [See also LATREILLE, **1804**, p. 52; RAILLIET, 1893, p. 713, and NEUMANN, 1897, p. 360, as syn. of ***Dermacentor reticulatus.***– FABRICIUS, 1805, p. 355, as syn. of *Ixodes reticulatus.*]

1806: *Ixodes reticulatus* (Fabricius) FABRICIUS, 1805, p. 355.—LATREILLE, **1806**, p. 157. IDEM, 1829, p. 288.—ILLIGER, 1807, p. 369. MOQUIN-TANDON, **1861**, p. 303. [See also GERVAIS, 1844, p. 240, as syn. of *Ixodes pictus.*] [See also



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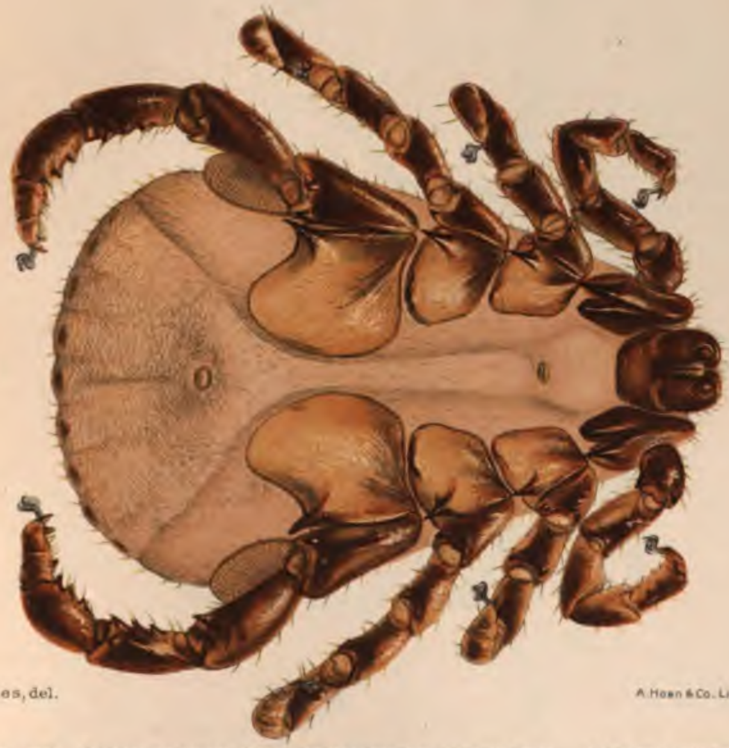

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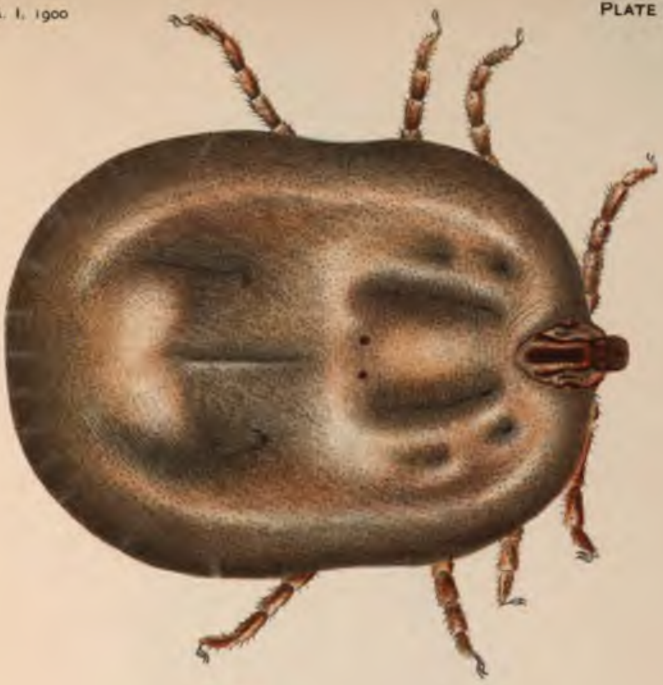
Haines, del.

A. Hoen & Co. Lithocaustic.

FIG. 169. DORSAL VIEW OF MALE DERMACENTOR RETICULATUS. GREATLY ENLARGED. ORIGINAL FROM LIFE. B. A. I., 3179; OKLAHOMA.

FIG. 170. VENTRAL VIEW OF SAME.



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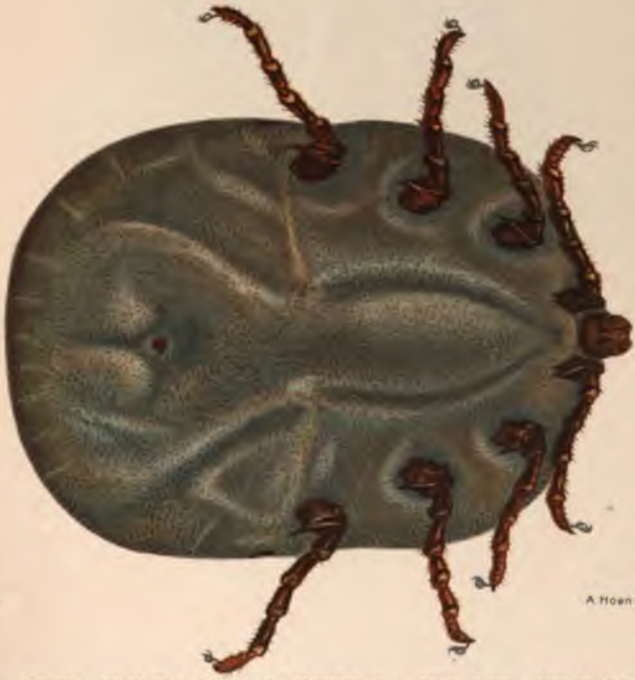

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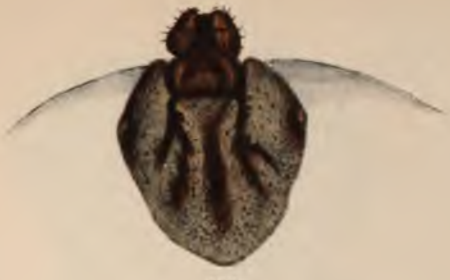
Haines, del.

A Hoen & Co. Lithocaustic.

FIG. 171. DORSAL VIEW OF FEMALE DERMACENTOR RETICULATUS. GREATLY MAGNIFIED. ORIGINAL FROM LIFE. B. A. I., 3179.

FIG. 172. VENTRAL VIEW OF SAME.



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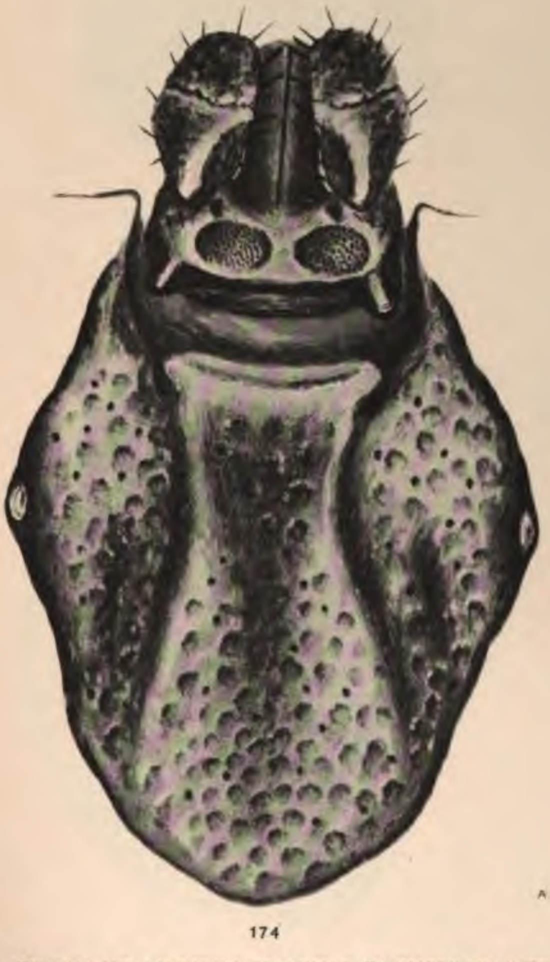

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A. Hoen & Co. Lithocaustic.

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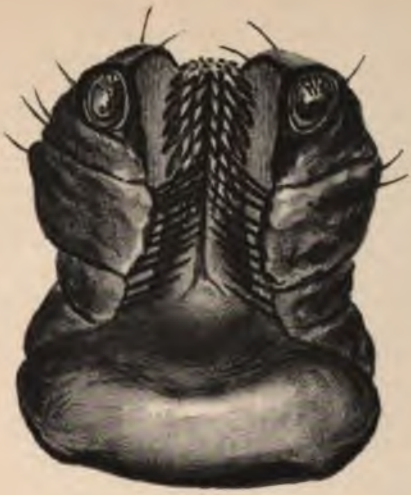
FIG. 173. SCUTUM AND CAPITULUM OF FEMALE DERMACENTOR RETICULATUS. GREATLY ENLARGED. ORIGINAL. B. A. I., 2998.

FIG. 174. DORSAL VIEW OF SAME.



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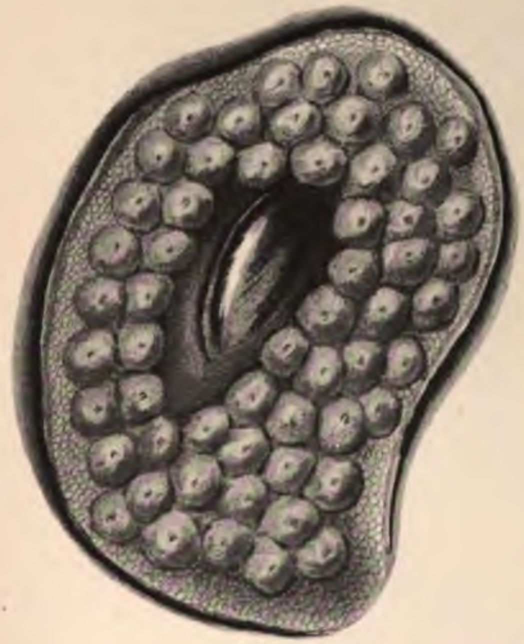

Haines, del.

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A Hoen & Co. Lithocaustic.

FIG. 175. VENTRAL VIEW OF CAPITULUM OF FEMALE DERMACENTOR RETICULATUS.

FIG. 176. STIGMEN OF FEMALE DERMACENTOR RETICULATUS. GREATLY MAGNIFIED TO SHOW WART-LIKE PUNCTATIONS. ORIGINAL. B. A. I., 2998.

metallic rust with rose and green tinges; anteriorly an ellipitical spot (pseudoscutum), very nearly representing in form and color the shield of the female, limited by a white border; then a median spot, a sort of center from which radiate white lines which border four anterior elongate brown spots arranged in an arc; three posterior elongate spots, the median spot being the larger, the two lateral spots may be somewhat semicircular. A marginal groove similar to that of the young female, limiting a border which is larger caudad, alternately marked with white and brown, and divided posteriorly into 11 distinct dorsal festoons; the white rust is occasionally almost effaced in the posterior half. Punctations are present on entire surface as in female. Ventral surface similar to that of the young female, except for the characters resulting from the form of the coxæ. Stigmata somewhat comma-form, a little more elongated. Capitulum differs from that of the female as follows: Length, 650 to 825 μ; base longer, square or slightly longer than broad or slightly broader than long.[1] Mandibles 1.1 to 1.4 mm. long, digit 130 to 150 μ; internal apophysis elongated transversely, with straight base, tooth large and bifide; external apophysis bidentate, terminal tooth subventral and small, the other very large. Denticles of

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Conil, 1877, p. 27; Railliet, 1893, p. 713, and Neumann, 1897, p. 360, as syn. of *Dermacentor reticulatus*.]

1826: *Ixodes marmoratus* Risso, 1826, pp. 182, 183.—Mégnin, 1880, p. 132.—Neumann, 1888, p. 93.—Idem, 1892a, p. 98.—Idem, 1892b, p. 101.—Perroncito (18—), p. 489.—Dolly, 1894, p. 1000. [See also Railliet, 1893, p. 713, and Neumann, 1897, p. 360, as syn. of *Dermacentor reticulatus*.]

1844: *Dermacentor reticulatus* (Fabricius) Koch, 1844, p. 235.—Idem, 1847, pp. 110–112, pl. XXIII, figs. 85, 86.—Canestrini, 1890, pp. 479, 485, 489, 519–523, Tav. XLI, fig. 4; XLII, fig. 3.—Railliet, 1893, pp. 713, 714.—Osborn, 1896, p. 262.—Neumann, 1897, pp. 360–365, 366, 367, 368, 369, 370, 381, 383, figs. 20, 21.—Ward, 1900a, p. 200.—Stiles & Hassall, 1901, p. 3.—Salmon & Stiles, 1901, pp. 448–452, figs. 61, 169–177.

1844: *Dermacentor albicollis* Koch, 1844, p. 236.—Idem, 1847, pp. 113, 114, pl. XIV, fig. 88. [See also Neumann, 1897, p. 360, as syn. of *Dermacentor reticulatus*.]

1844: *Dermacentor pardalinus* Koch, 1844, p. 235.—Idem, 1847, pp. 114, 115, pl. XXIV, fig. 89.—Murray, 1877, p. 199, figs. 2. [See also Neumann, 1897, p. 360, as syn. of *Dermacentor reticulatus*.]

1844: *Dermacentor ferrugineus* Koch, 1844, p. 236.—Idem, 1847, pp. 118, 119, pl. XXV, fig. 92. [See also Neumann, 1897, pp. 360, 364, as syn. of *Dermacentor reticulatus*.]

1857: "*Ixodes holsatus* (Fabricius)" of Kolenati, 1857, p. 24, pl. II. [See also Neumann, 1897, p. 360, as syn. of *Dermacentor reticulatus*.]

1871: *Ixodes 5-striatus* Fitch, 1871, p. 366; type locality, Virginia.

1882: *Pseudixodes* "*holsatus* (Fabricius)" Haller, 1882, pp. 311, 312, pl. V, fig. 5. [See also Canestrini, 1890, pp. 485, 526, as doubtful syn. of *Hæmaphysalis punctata*, and Railliet, 1893, p. 714.—Neumann, 1897, pp. 360, 364, as syn. of *Dermacentor reticulatus*.]

1887: *Hæmaphysalis marmorata* Berlese, 1887, fasc. xlvii, No. 4. [See also Neumann, 1897, p. 360, as syn. of *Dermacentor reticulatus*.]

1892: "*Dermacentor occidentalis* Marx, the Western deer tick," in Curtice, 1892b, pp. 226, 234.—Idem, 1892c, p. 237.—Railliet, 1893, p. 714 (of California).—Morgan, 1899, p. 134.—Ward, 1900a, p. 200. [See also Neumann, 1897, p. 365, as syn. of *Dermacentor reticulatus*.] [Not "*Dermacentor occidentalis* Marx" of Niles, 1898b, pp. 28, 29, 30, pl. IV, figs. 1, 2, *Amblyomma*.]

1897: *Dermacentor venustus* Marx in Neumann, 1897, p. 365, as syn. of *Dermacentor reticulatus*.

[1] In all specimens at our disposal at present, it is slightly broader than long.

the hypostome disposed in only three rows each side. Palpi extending beyond hypostome by scarcely a third of the length of the third article; first article longer, second and third shorter than in the female; dorsal retrograde point of second article may be quite pronounced, especially on large specimens. Coxæ increase in size from I to IV, their median border parallel to median line of body; coxæ of right and left sides are very close; coxæ IV very large, at first twice afterwards (in the adult) three times the size of the III pair, their median half greatly prolonged posteriorly, may extend to the plane of the posterior extremity of the peritremes; prominences same as in female. Two spines each on tarsi II to III; three spines on coxæ IV; ventral border of IV femur, tibia, and protarsus trispinate.

Young female.—Body depressed, with oval contour, broader posteriorly than anteriorly, 5 mm. long by 2.5 mm. broad; color, reddish brown, except the dorsal shield; capitulum, legs, and margin of superior surface somewhat lighter; scutum very large, extending posteriorly to the niveau of the insertion of the III pair of legs, with elliptical outline, slightly sinuous, with an anterior emargination limited by two blunt projecting angles; cervical grooves concave laterally, transformed into deep fossettes at their posterior extremity; two kinds of punctations; some large, numerous especially on the sides, the others very fine, numerous on entire surface; color, milk white, or in some live specimens silver white, with iridescent rose to green, covering occasionally entire shield except the grooves, the punctations and a median, poorly limited, longitudinal spot, even extending over a part of the dorsal base of the capitulum and the palpi; at other times accentuated more on the borders, becoming weaker as it elongates, and allowing the deep brown red to appear. Eyes pale brown, situated a little anterior of the middle of the lateral margin. Dorsal surface of the abdomen with a marginal groove commencing back of the eyes, and three longitudinal grooves extending caudad to the marginal groove, the two laterals commencing near the posterior border of the scutum, the median some distance farther; some irregular wrinkles. Posterior margin, beginning at the stigmata, is divided into eleven festoons; lateral festoons larger than the median. Punctations scattered in irregular longitudinal series on the entire surface. These punctations are numerous, of unequal size, and the largest bear short hairs; ventral surface also provided with fine hairs; genital pore at height of coxæ II; sexual grooves very close together in their anterior portion, then diverging very sharply back of coxæ IV and terminating between the second and third anterior festoons of the posterior margin. Ano-marginal groove relatively short. Anus with very short hairs on its anterior border. Stigmal plate comma-shape, short, with truncated point, rounded. Capitulum 720 μ long (from its posterior dorsal border to the extremity of the hypostome), each posterior lateral angle prolonged into a short point; porose areas circular; mandibles 1.1 mm. long, the digit measuring 150 μ. Internal apophysis of digit with large base and strong posterior tooth; external apophysis with three successive teeth, one terminal, a little subcentral, the second larger, the third still larger. Hypostome spatulate; anterior denticles numerous and very small; proximal denticles very strong, on each

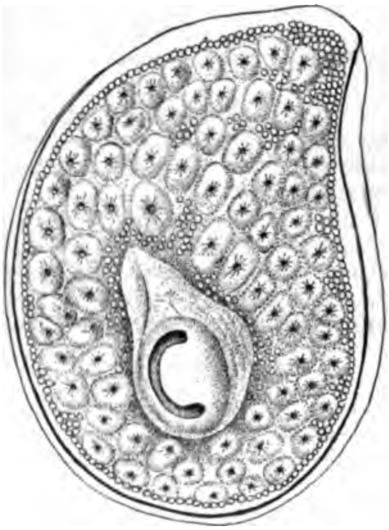

FIG. 177.—Stigmen of another specimen of *Dermacentor reticulatus;* female from Tennessee. Greatly enlarged, showing structure. Original. B. A. I. Coll. 3206.

side in four,[1] then in three longitudinal rows of ten to eleven each; the denticles of each transverse row being equal, diminishing gradually in size proximally, and finally becoming squamiform. Palpi noticeably longer than hypostome, which they overreach in front by about one-half of their third article, almost as broad as long; first article short and annulate; second and third articles larger, convex laterally, decidedly valvate; all three articles provided with strong bristly barbed hairs on their ventro-internal border; postero-dorsal border of the second article prolonged in a blunt retrograde point of variable length, extending over the dorsal surface of the first article; dorsal surface of third article triangular; fourth article small, cylindrical, infero-terminal. Legs of average length, coxæ slightly longer than broad; coxæ I decidedly bidentate; coxæ II to IV with a rather strong spur on the middle of their posterior edge. Long hairs on all the articles, coxæ included, especially on the ventral edge, which is rather festooned by their insertions. A strong recurved, terminal spine on tarsi II–IV, feeble on the pair I; pulvillum attaining nearly the length of the middle of the hooks.

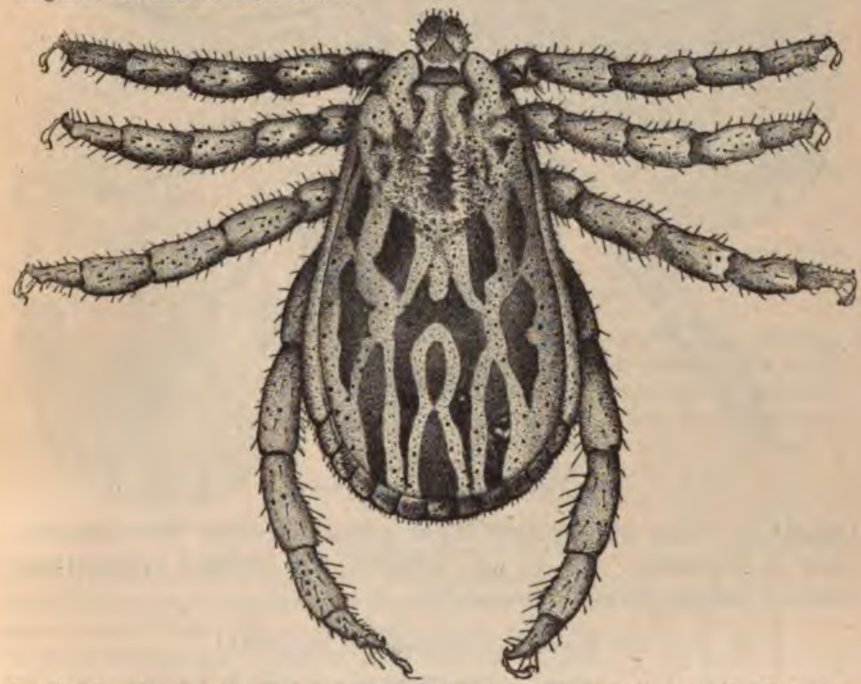

FIG. 178.—Dorsal view, male *Dermacentor variegatus* from the wapiti; Blue Mountains, New Hampshire Notice the pseudo-scutum on anterior portion. Greatly magnified. Original. B. A. I. Coll. 3172.

Replete female.—Body more or less swollen, slightly constricted laterally at the stigmata, may attain 16 mm. long by 10 mm. broad; of a deep brown to slate color; legs almost black (alcohol specimens), brown (live specimens). Scutum, with thin, silvery white metallic rust, with some rose to greenish tinge. Grooves become more effaced as body becomes larger; punctations also nearly disappear; nearly all the hairs are lost. Capitulum, 800 to 900 μ.

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[1] We have been able to find only three rows of denticles on the American specimens of this species. In some cases, however, the teeth on the apophysis of the mandibles assumed a position which gave the appearance of a fourth row. Both Canestrini (1890, p. 520, Tav. XLI, fig. 4d) and Neumann (1897, p. 362) agree that there are four rows anteriorly, then three rows posteriorly.

This species is subject to great variation in appearance, a fact which has resulted in different specimens being described as representing distinct species.

It has been collected from man, cattle, horses, deer, roe deer, sheep, fallow deer, and rhinoceros, and has a very wide geographical distribution. It is recorded in this country for California, Texas, and New Mexico, and also from various countries in Europe and Asia.

The description given above is, with slight modifications, a direct translation from Neumann. Two sendings which have recently reached us—one from horses in Tennessee, the other from cattle in Oklahoma—show exceedingly slight variations from the characters cited by Neumann. We do not, however, feel justified in describing them as distinct from *D. reticulatus*.

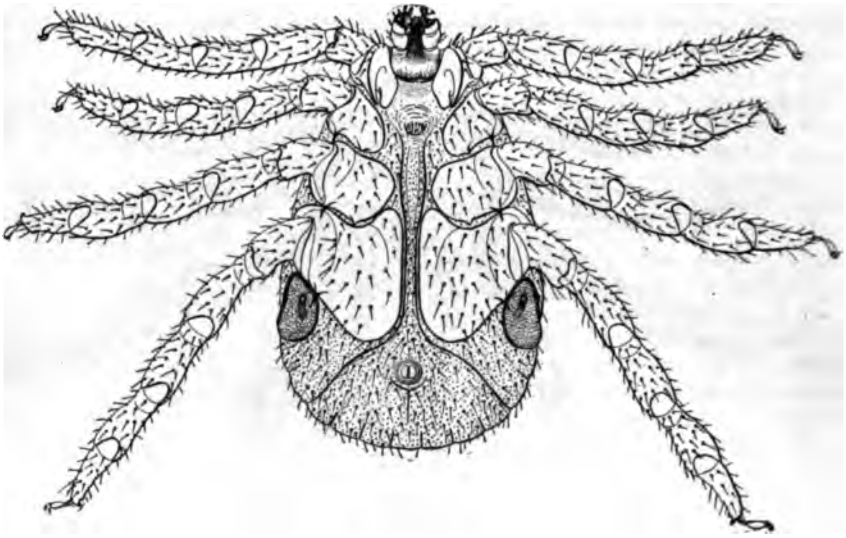

FIG. 179.—Ventral view of same.

THE MOOSE TICK (*Dermacentor variegatus*).[1]

(Figs. 178–185.)

SPECIFIC DIAGNOSIS.—*Dermacentor:* Stigmal plate coarsely punctate.

Male.—Body subtriangular, sides nearly straight, posterior end rounded, 6.5 mm. long, 1.1 mm. broad anteriorly to 4.3 mm. posteriorly. Scutum deep reddish brown, nearly covered with a regularly distributed whitish rust, which indistinctly limits an anterior reddish brown portion (pseudo-scutum), somewhat resembling in form and color the female scutum, and leaving following portions reddish brown; (1) 4 longitudinal dark spots arranged in a semicircle posterior of the pseudo-scutum;

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[1] SYNONYMY AND BIBLIOGRAPHY.

1897: *Dermacentor variegatus* MARX & NEUMANN, 1897, pp. 367–370, 383, figs. 22–24.—WARD, 1900a, p. 201.—STILES & HASSALL, 1901, p. 3.—SALMON & STILES, 1901, pp. 452–454, figs. 178–185.

(2) 1 elongate reniform dark spot back of these, near side of shield; (3) 1 more or less distinct forked longitudinal dark band extending from pseudo-scutum to near posterior margin; 1 median, 2 submedian elongate dark spots, posterior; (4) marginal groove, external border, and 5 median postero-marginal shields are also dark. Entire surface finely and sparsely punctate, with microscopic white hairs. Ventral surface as in the female, except differences due to coxæ. Genital pore between coxæ II. Stigmata round to comma-shaped. Capitulum 700 μ long; base same dimension as in female, postero-lateral angle prolonged, prominent; digit of mandibles 185 μ, similar to those of male *D. reticulatus;* hypostome as in *D. reticulatus;* palpi shorter than in female, especially second article. Legs: coxæ increase in size and become more convergent from I to II; pair IV very large; their posterior margin may be about on a line with posterior margin of stigmata, their median margin nearly parallel for some distance; same projections as in female, but postero-median tubercle absent from coxæ IV; other articles of legs similar to *D. reticulatus.*

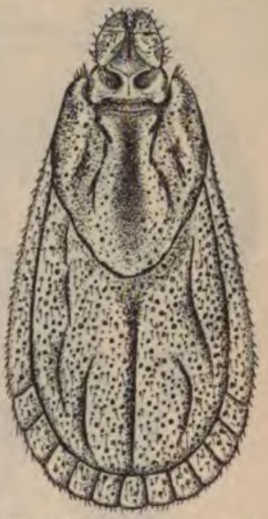

FIG. 180.—Dorsal view, female *Dermacentor variegatus.* B. A. I. Coll. 3172.

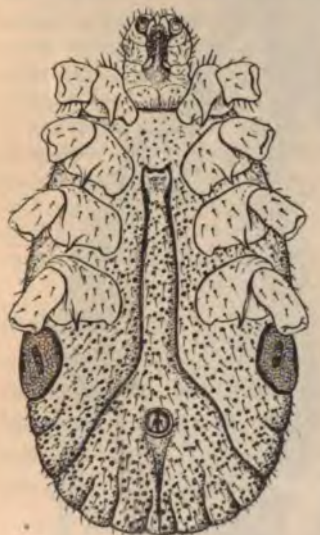

FIG. 181.—Ventral view of same.

Female.—Body depressed, oblong, sides nearly parallel, nearly as broad anteriorly as posteriorly, 5 to 17 mm. long, 2.5 to 10 mm. broad, color reddish brown (alcohol specimens); capitulum and legs not so dark. Scutum elongate, subpentagonal, extending nearly to the middle of the back in young specimens, deeply excavate anteriorly, so as to form two antero-lateral acute points; cervical grooves curved, deep in front, broad and not very distinct in back; punctations fine, numerous; color light brown, with some thin white rust of slightly metallic effect, and leaving exposed a median longitudinal band, the cervical grooves, and a small band along the convexity of the latter, and a brown spot median of the light brownish eyes. Dorsal surface roughened with numerous punctations provided with very short whitish hairs; marginal grooves well marked; 3 longitudinal grooves. Ventral surface covered with fine hairs; genital pore between coxæ II, narrow, oval, surrounded by a broad swelling; genital grooves close to each other in their anterior portion; diverging back of coxæ IV; the genital and anomarginal grooves similar to those of *D. reticulatus.* Stigmata larger than coxæ IV, whitish or brownish, irregularly oval, with or without dorsal prolongations. Capitulum 1 mm. long, posterior border sinuous, postero-lateral angles slightly or prominently salient; porose areas deep. Mandibular digit 180 μ long, similar to that of

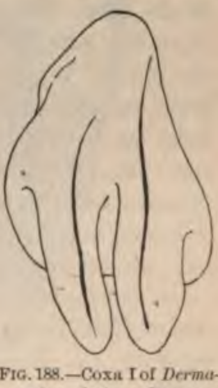

FIG. 188.—Coxa I of *Dermacentor electus;* diagram. Greatly enlarged. Original.

D. reticulatus. Hypostome similar to that of *D. reticulatus*, with three rows of denticles on each half. Palpi slightly longer than hypostome, at least twice as long as broad, not extending laterally of base of capitulum; second article longer than broad, dorsal retrograde projection small; third article slightly broader than long, its apex rounded; second and third articles provided with hairs, especially ventrally. Legs relatively long, all articles with hairs. Coxæ approximated (in young specimens); coxæ I bidentate, the lateral division forming a spine; coxæ II to IV with small acute spine near postero-lateral angle, and a flat tubercle at postero-median angle; trochanters I with broad dorsal retrograde spine; tarsi with tubercles on ventral border; all legs with terminal spur; pulvillum reaches nearly to recurved portion of claws.

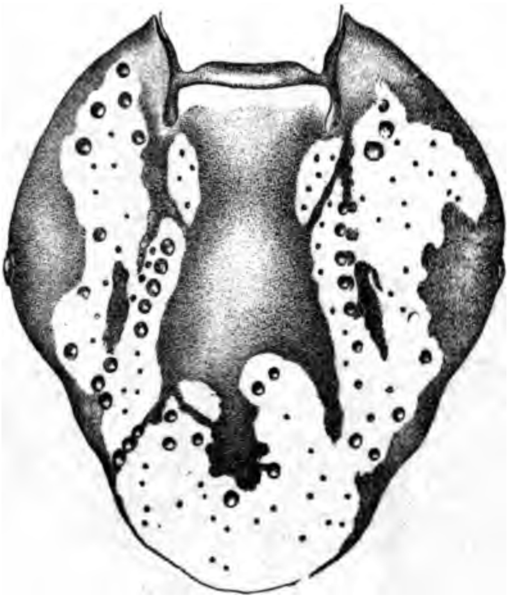

FIG. 189.—Scutum of female of *Dermacentor electus.* Greatly enlarged. Original.

This species is abundant on the wapiti (*Cariacus canadensis*); it has been collected in Washington (State), Nebraska, Nevada, and New York (Adirondacks). Complaints have been made to this Bureau that it is exceedingly common on wapiti in the reserve of the Blue Mountain Forest Association, and according to reports from the gamekeepers it kills numbers of the deer. Whether the wapiti really die from the direct effects of the bite of these ticks (as seems improbable), from its indirect effects by the transmission of some disease, from liver fluke disease caused by *Fasciola magna*, or from some other cause has not, in our opinion, been established.

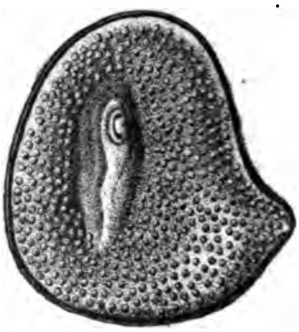

FIG. 190.—Stigmen of same. Greatly enlarged. Original.

D. variegatus is not yet recorded for steers, but there can be little doubt regarding the likelihood of its attacking cattle.

There is a question in our minds whether *D. variegatus* is really specifically distinct from *D. reticulatus.* Neumann admits that good anatomical differences are lacking, and that it may perhaps be simply a variety of *D. reticulatus.*

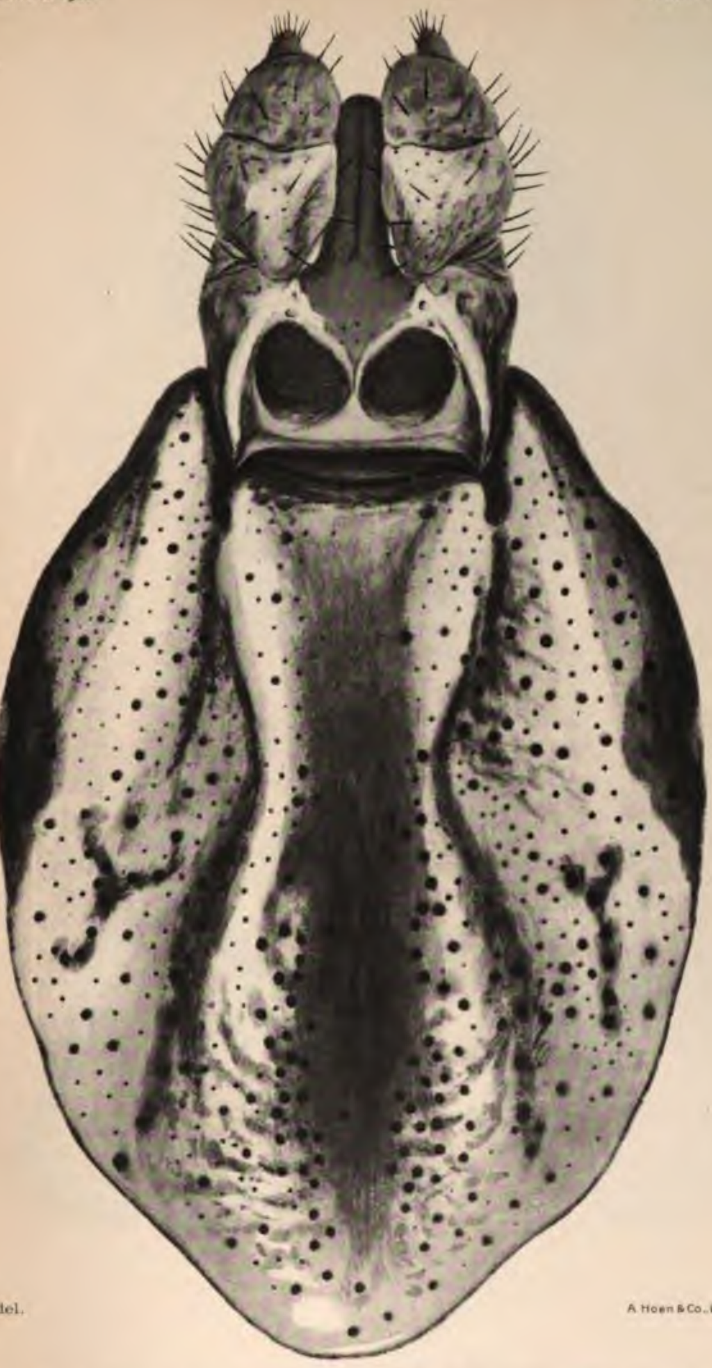

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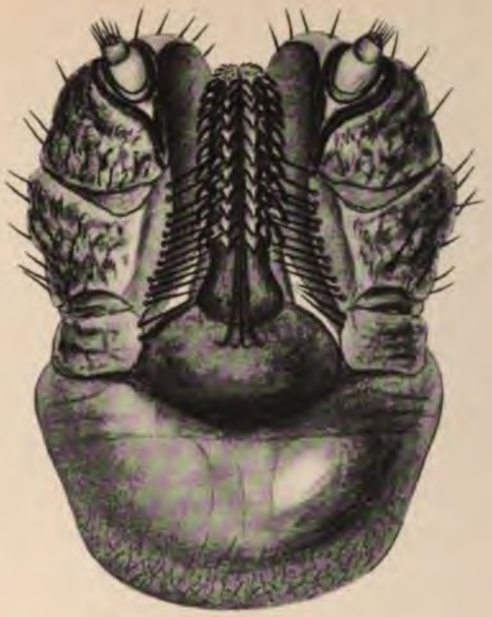
FIG. 182. DORSAL VIEW OF SCUTUM AND CAPITULUM OF DERMACENTOR VARIEGATUS.

PLATE LXXXVII.



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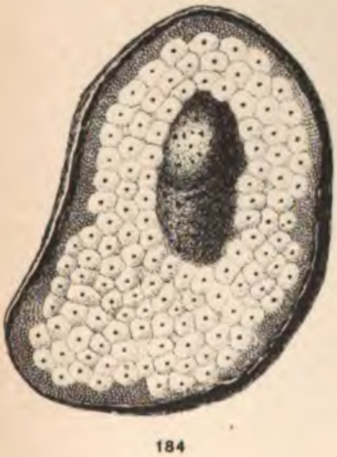

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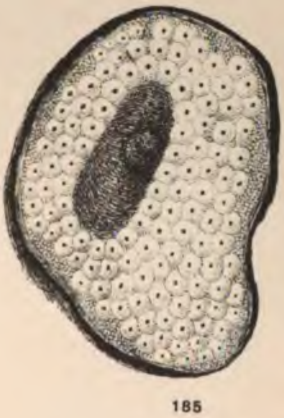

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FIG. 183. VENTRAL VIEW OF CAPITULUM OF DERMACENTOR VARIEGATUS.

FIG. 184. STIGMEN OF MALE. GREATLY ENLARGED TO SHOW COARSE PUNCTATION. ORIGINAL.

FIG. 185. STIGMEN OF FEMALE. GREATLY ENLARGED. ORIGINAL.

THE AMERICAN DOG TICK (*Dermacentor electus*).[1]

(Figures 186–214.)

SPECIFIC DIAGNOSIS—*Dermacentor:* Differs from *D. reticulatus* in following characters: Stigmal plate finely punctate.

Male.—Scutum with milky white rust, reproducing anteriorly the shield of the female (pseudo-scutum); the rust forms on each side a long band with sinuous borders extending from the anterior point of the shield to the two extreme festoons of the posterior border. These bands leave laterally two red brown spots (separated by a narrow transverse white band) and the marginal border where there are two white spots opposite the dark spots. Between their divergent posterior extremities the two longitudinal bands are united by two other parallel longitudinal bands occupying a third of the length of the shield, and only the borders and posterior extremities of which are white. All the festoons are brown except occasionally the extremes of each side; punctations larger and deeper. Capitulum: digit of the mandibles 130 to 140 μ long, thicker, the internal apophysis almost terminal; palpi shorter and more convex laterally than in the female; dorsal retrograde projection of second article not very prominent. Stigmal plates comma-shaped to elongate oval. Legs: coxæ IV do not extend caudad of the middle of the peritreme; otherwise like the male of *D. reticulatus.*

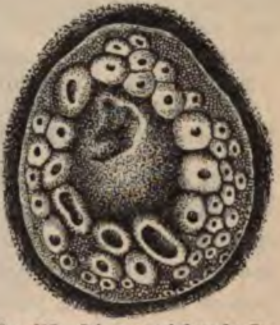
FIG. 215.—Stigmen of female *Dermacentor nitens*, from ear of pony. Porto Rico. Greatly enlarged. Original. B. A. I. Coll. 3102.

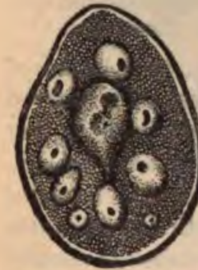
FIG. 216.—Stigmen of male *Dermacentor nitens*, from ear of pony. Porto Rico. Greatly enlarged. Original. B. A. I. Coll. 3102.

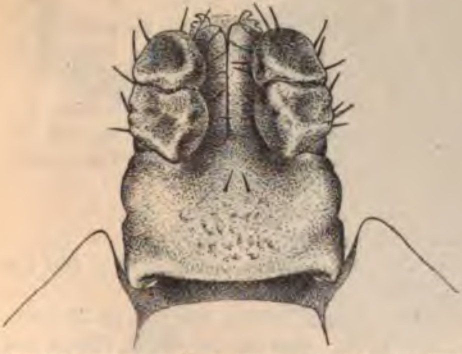
FIG. 217.—Dorsal view, capitulum of male *D. nitens.* B. A. I. Coll. 3102.

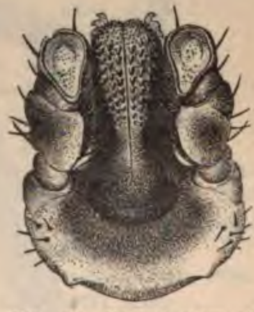
FIG. 218.—Ventral view of same.

Female, straighter. Scutum straighter, more elongate, with a scarcely distinguishable sinus on posterior third of lateral border; anterior emargination limited by two acute projecting angles; cervical grooves deep anteriorly, superficial in the posterior two-thirds; yellowish white rust

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[1] SYNONYMY AND BIBLIOGRAPHY.

1844: *Dermacentor electus* KOCH, 1844, p. 235; type locality, Pennsylvania.—IDEM, 1847, p. 109, pl. XXII, figs. 83, 84.—SALMON & STILES, 1901, pp. 455, 456, less abundant, leaving a free space between the two grooves, except in the posterior part; eyes near middle of the lateral border. Dorsal surface with fewer hairs, which are scarcely visible. Capitulum straighter. Mandibles 1.5 mm. long; digit 165 μ. Hypostome with three rows of 12 to 13 short broad denticles. Palpi a little longer, straighter, slightly convex laterally; third article less triangular on its dorsal surface; hairs less numerous on the internal ventral surface of the first to third articles; a few hairs on the internal dorsal border. Stigmal plates comma-shaped to elongate oval. Coxæ relatively a little more elongated; articles of legs a little narrower; tarsi I without spur; pulvillum extends beyond the middle of the hooks.

Replete female attains 15 mm. in length by 9 mm. in breadth.

This tick has been taken from man, cattle, dogs, horses, panther, rabbits, and elan. It is abundant and widely distributed, especially east of the Rocky Mountains.

The above description, which is almost a verbatim translation of Neumann's work, was apparently based upon a number of preserved specimens. Our experience with live and preserved specimens is that the coloration and spots are exceedingly variable, but that the punctation of the stigmal plates is a reliable and easily recognizable character by which *D. electus* may be readily distinguished from both *D. reticulatus* and *D. variegatus*. It may also be remarked that *D. electus* is usually smaller than *D. reticulatus* and *D. variegatus*.

It has been very generally supposed that this was the form to which Linnæus originally gave the name *Acarus americanus*, and authors have on this account referred to it under the name *Dermacentor americanus*. As will be seen from discussion on page 477, we believe that a confusion has arisen between this and *Amblyomma americanum*.

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figs. 186–214. [See also NEUMANN, 1897, p. 366, as syn. of *Dermacentor americanus.*]

1889: ? "*Ixodes bovis* Riley" of COOK, 1889, pp. 229, 230. figs. 81–83.

1892: "*Dermacentor americanus*" (Linnaeus) of CURTICE, 1892b, pp. 226, 231, 234.—IDEM, 1892c, p. 237.—RAILLIET, 1893, p. 714, in part.—OSBORN, 1896, p. 261, fig. 153.—MARX, 1892, p. 236.—LUGGER, 1896, pp. 120–122, figs. 61, 62.—NEUMANN, 1897, pp. 365–367, 383.—NILES, 1898, pp. 28, 30, pl. III, figs. 1–5.—DALRYMPLE, MORGAN & DODSON, 1898, p. 241.—MORGAN, 1899, pp. 128, 129, 133, 134, 135, 141, pls. V–VI.—WARD, 1900a, pp. 200–201, fig. 4.—IDEM, 1900b, pp. 436–437, fig. 259.

1892: "*Dermacentor americanum* Linn." of CURTICE, 1892b, p. 226.

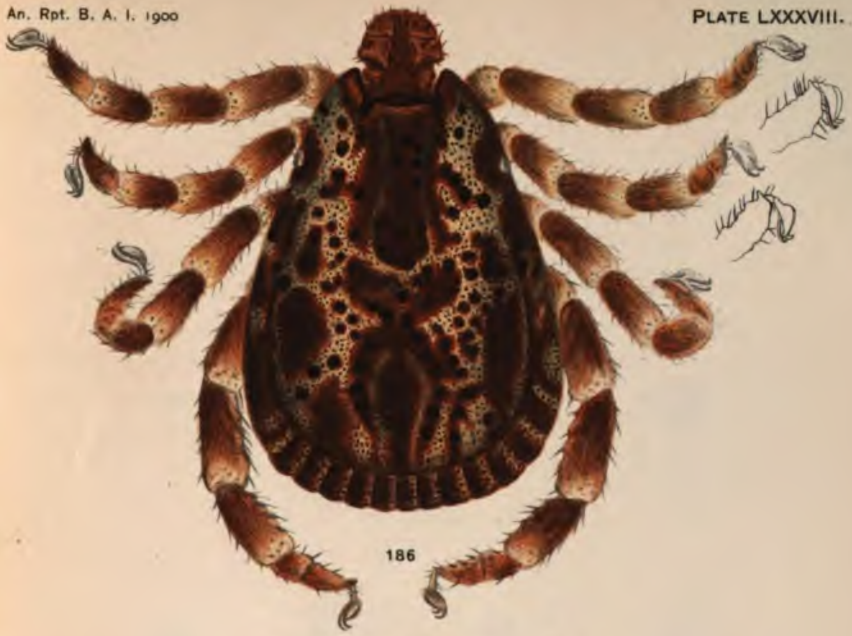
1894: "*Dermacenter americanus*" (Linnaeus) of FRANCIS, 1894, p. 451.

1869: *Ixodes naponensis* PACKARD, 1860, p. 65. [See also NEUMANN, 1897, p. 366, and WARD, 1900b, p. 436, as syn. of *Dermacentor americanus.*]

1869: *Ixodes albipictus* PACKARD, 1869, p. 65.—VERRILL, 1870, p. 118, figs. 42–44.—CORBOLD, 1879, p. 350.—HOLLAND, 1898, p. 96. [See also NEUMANN, 1897, p. 366, as syn. of *Dermacentor americanus.*—WARD, 1900b, p. 436.—Moose tick (American Naturalist, 1868, p. 559.]

1870: "*Ixodes albiptctus* Packard" of VERRILL, 1870, p. 117 (misprint for *I. albipictus*).

1899: "*Dermocenter americanus* Linn." of LEWIS, 1899, p. 3.



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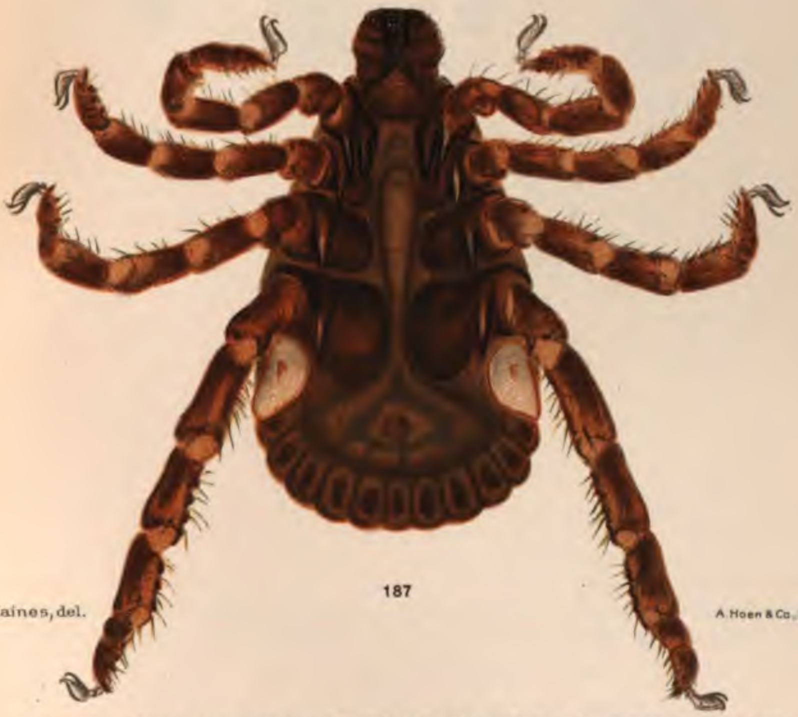

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FIG. 186. DORSAL VIEW OF MALE DERMACENTOR ELECTUS FROM DOG; MARYLAND. GREATLY ENLARGED. ORIGINAL FROM LIFE. B. A. I., 3150.

FIG. 187. VENTRAL VIEW OF SAME.

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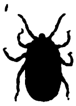

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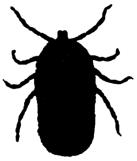

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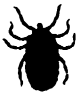

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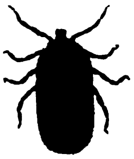

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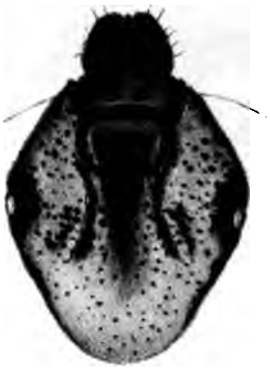


203

A Hoen & Co. Lithocaustic

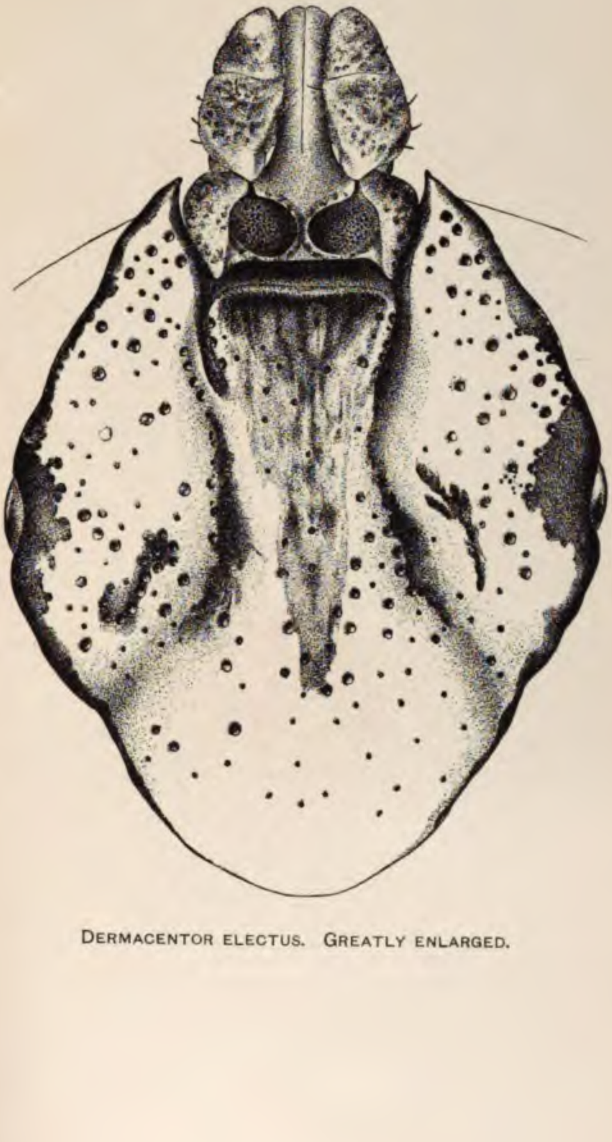
FIGS. 191 (MALE), 195 (YOUNG FEMALE), 199 (FEMALE). DORSAL VIEW OF DERMACENTOR ELECTUS FROM CATTLE; GRAND ISLAND, NEBR. NATURAL SIZE. ORIGINAL FROM LIFE.

FIGS. 192, 196, 200. THE SAME. X2.

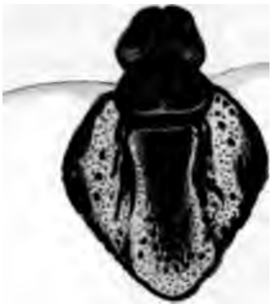
FIGS. 193, 197, 201. VENTRAL VIEW OF SAME. NATURAL SIZE.

FIGS. 194, 198, 202. THE SAME. X2.

FIG. 203. SCUTUM AND CAPITULUM OF FEMALE. ENLARGED. ORIGINAL FROM LIFE.



DERMACENTOR ELECTUS. GREATLY ENLARGED.



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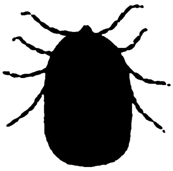
205



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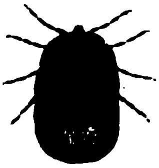
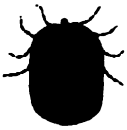
209



211



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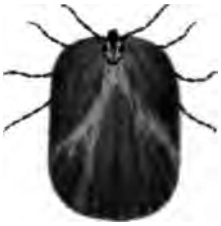

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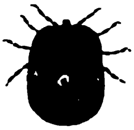

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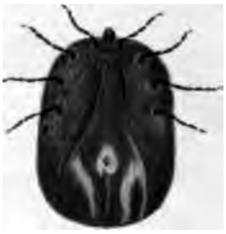

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Haines, del.

A Hoen & Co. Lithocaustic.

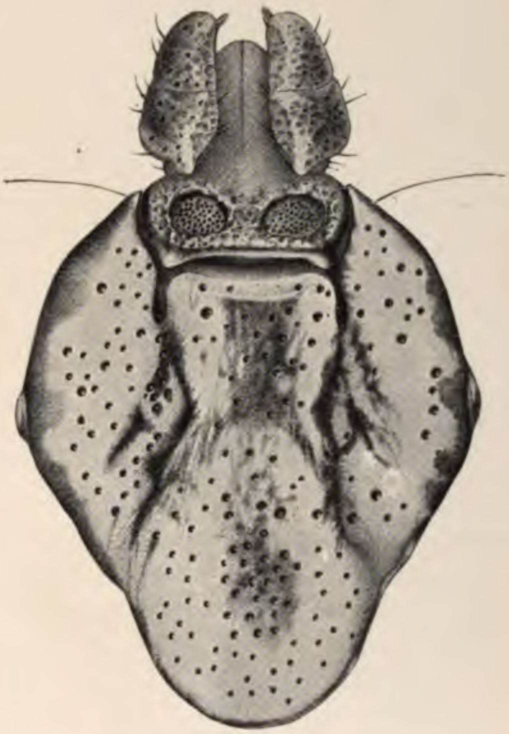
FIGS. 205, 206. DORSAL VIEWS OF FEMALE DERMACENTOR ELECTUS FROM CATTLE: ST. JOSEPH, MO. NATURAL SIZE. ORIGINAL FROM NATURE. B. A. I., 3011.

FIGS. 207, 208. THE SAME. X2

FIGS. 209, 210. VENTRAL VIEW OF SAME.

FIGS. 211, 212. THE SAME. X2

FIG. 213. SCUTUM OF FEMALE. GREATLY ENLARGED. ORIGINAL.



DERMACENTOR ELECTUS. GREATLY ENLARGED.

GENUS HÆMAPHYSALIS[1] Koch, 1844.

GENERIC DIAGNOSIS.[2]—*Ixodinæ*: Eyes absent. Base of capitulum rectangular, twice as broad as long. Palpi conical, second article with strong conical latero-basal projection. Stigmal plate circular or in short comma. Anal shields of male absent. Coxæ I not bifide; coxæ IV of normal dimensions in male.

Teguments of uniform color, brownish.

TYPE SPECIES.—*Hæmaphysalis concinna.*

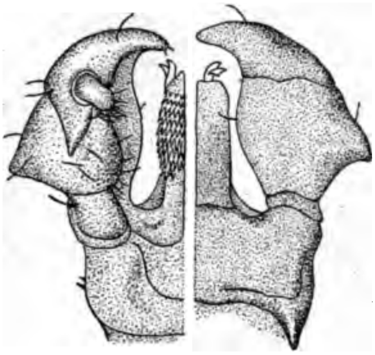


FIG. 219.—Capitulum of male *Hæmaphysalis concinna:* ventral and dorsal view of right half. X 65. After Neumann, 1897, p. 339, fig. 4.

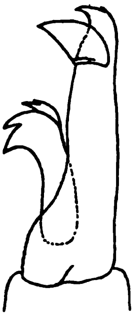


FIG. 220.—Digit of left maxilla of same. X 230. After Neumann, 1897, p. 340, fig. 5.

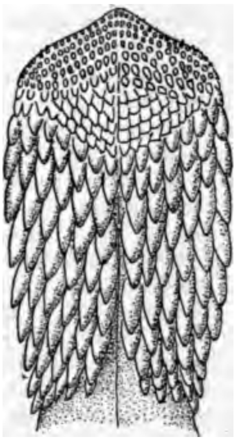


FIG. 221.—Hypostome of same. X 210. After Neumann, 1897, p. 340, fig. 6.

Neumann mentions two North American species, *H. leporis-palustris* and *H. concinna*, neither of which appears to have been reported for cattle.

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[1] SYNONYMY AND BIBLIOGRAPHY.

1844: *Hæmaphysalis* KOCH, 1844, p. 237.—IDEM, 1847, p. 239.—FÜRSTENBERG, 1861, p. 208.—MURRAY, 1877, p. 199.—CANESTRINI & FANZAGO, 1877, pp. 178, 186, 188–190.—CAMBRIDGE, 1889, p. 406.—CANESTRINI, 1890, pp. 476, 481, 483, 484, 485, 486, 487, 488, 490, 491, 493, 523–526.—IDEM, 1892, p. 581.—MARX, 1892, pp. 233, 236.—TROUESSART, 1892, p. 47.—RAILLIET, 1893, pp. 714, 715.—NEUMANN, 1897, pp. 325, 326–359.—MORGAN, 1899, p. 139.—WARD, 1900a, p. 200.—SALMON & STILES, 1901, pp. 456–458. [See also CURTICE, 1891a, p. 317, and 1891b, p. 685.]

1844: *Rhipistoma*, KOCH, 1844, p. 239.—IDEM, 1847, p. 27.—FÜRSTENBERG, 1861, p. 208.—CANESTRINI, 1890, pp. 483, 486.—MARX, 1892, pp. 233, 236; type, *Leachii*. [See also NEUMANN, 1897, p. 326, as syn. of *Hæmaphysalis.*]

1888: *Gonixodes* DUGÈS, 1888, pp. 129–133; type, *rostralis* = *H. leporis-palustris*. [See also CANESTRINI, 1890, p. 485.—MARX, 1892, p. 236.—NEUMANN, 1897, p. 326.]

1897: *Opisthodon* CANESTRINI, 1897, p. 468; type, *cuscobius*. [See also NEUMANN, 1897, p. 326, as syn. of *Hæmaphysalis.*]

1899: "*Gonixides* Dugès" of MORGAN, 1899, p. 139.

[2] Neumann (1897) suppresses *Opisthodon* as synonym of *Hæmaphysalis*. While not acquainted with any species of *Opisthodon*, the characters attributed to this genus would indicate to our minds that it is entitled to subgeneric rank, possibly to generic rank.

Key to the Species of the Genus Hæmaphysalis.[1]

[For forms reported for the United States, follow Roman type.]

Females 1
Males 15

A.—Female.

1. Second palpal article angular or rounded laterally 2
Second palpal article acute, spinescent (laterally) 12
2. Palpi as broad as long, or broader than long 3
Palpi longer than broad .... *H. leporis-palustris.*
3. Scutum punctate 4
Scutum not punctate .... *H. rhinolophi.*
4. Coxæ I provided with a spine 5
Coxæ I without a spine (Tunis) .... *H. erinacei.*
5. *Tarsi IV less than four times as long as broad* 6
Tarsi IV at least four times as long as broad 10
6. *Scutum as broad as long or nearly so, and with sides convex* 7
Scutum much longer than broad; sides nearly straight (Brazil) .... *H. sanguinolenta.*
7. *Second palpal article rounded laterally* 8
Second palpal article angular laterally 9
8. *Ventral aspect of uniform color* (Europe, Asia, Africa) .... *H. punctata.*
Ventral aspect whitish around vulva and anus (Brazil) .... *H. cinnaberina.*
9. *Third papal article with a ventral spine* (Asia) .... *H. flava.*
Third palpal article without ventral spine (New Guinea, Australia) .... *H. papuana.*
10. Third palpal article without dorsal horn 11
Third palpal article with dorsal retrograde horn (India) .... *H. bispinosa.*
11. Tarsi I five times as long as broad .... *H. concinna.*
Tarsi I three times as long as broad (Asia) .... *H. hirudo.*
12. *A simple tuberosity on coxæ IV* 13
A sharp spine on every coxa (Madagascar) .... *H. elongata.*
13. *Scutum much longer than broad* (Africa) .... *H. Leachi.*
Scutum scarcely or not longer than broad 14
14. *Second palpal article with retrograde prolongation* (Asia) .... *H. spinigera.*
Second palpal article without retrograde prolongation (Singapore, Borneo, Sumatra) .... *H. cornigera.*

B.—Male.

15. Third palpal articles not forming pincers together 16
Third palpal articles prolonged toward median line and meeting to form pincers .... *H. concinna.*
16. Coxæ I provided with a spine 17
Coxæ I without spine .... *H. erinacei.*
17. External angle of second palpal article without dorsal retrograde prolongation 18
External angle of second palpal article with dorsal retrograde prolongation 24
18. External angle of second palpal article without ventral retrograde prolongation 19
External angle of second palpal article with ventral retrograde prolongation (Asia) .... *H. spinigera.*
19. Spine of coxæ I feeble or nil 20
Spine of coxæ I strong (Singapore, Borneo, Sumatra) .... *H. cornigera.*

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[1] This key does not contain the species *Birmaniæ, histricis, cuscobia, Canestrinii, asiatica*, and *Gestroi.*

20. *External angle of second palpal article rounded* (Europe, Asia, Africa). *H. punctata.*
External angle of second palpal article angular 21
21. *Each palpus nearly as broad as long* 22
Each palpus much longer than broad .... *H. leporis-palustris.*
22. *Third palpal article with ventral retrograde projection* 23
Third palpal article without ventral retrograde projection (New Guinea, Australia) .... *H. papuana.*
23. *Cervical furrows very deep; second and third palpal articles not separated by a reentrant angle* (Asia) .... *H. flava.*
Cervical furrows rudimentary; second and third palpal articles separated laterally by a reentrant angle (Madagascar) .... *H. simplex.*
24. *Dorsal surface of palpi, longer than broad* (Madagascar) .... *H. elongata.*
Dorsal surface of palpi as broad as long or broader (Africa) .... *H. Leachi.*

C.—Based upon the denticles of the hypostome.

Two rows on each half; nymph; American .... *H. leporis-palustris.*
Two rows on each half; nymph and larva; not American .... *H. punctata.*
Three rows: *H. leporis-palustris* ♂ ♀; *H. simplex*, nymph; *H. elongata* ♂ ♀.
Four rows: *H. flava* ♂ ♀; *H. Birmaniæ* ♀; *H. papuana* ♂ ♀; *H. bispinosa* ♀; *H. simplex* ♂; *H. Leachi* ♀; *H. cornigera* ♀; *H. spinigera* ♀; *H. Canestrinii* ♂.
Five rows: *H. punctata* ♂ ♀; *H. rhinolophi* ♀; *H. flava* ♂; *H. Birmaniæ* ♂; *H. concinna* ♀; *H. hystricis* ♂ ♀; *H. Leachi* ♂ ♀; *H. cornigera* ♂; *H. cuscobia* ♂; *H. spinigera* ♂.
Six rows: *H. flava* ♂; *H. concinna* ♂; *H. asiatica* ♂.
Seven rows: *H. Gestroi* ♀.

Subfamily Ixodinæ[1] Salmon & Stiles, 1901.

Subfamily diagnosis.—*Ixodidæ:* Palpi long, usually about the same length as the hypostome.

Type genus.—*Ixodes.*

This subfamily includes the genera *Ixodes*, *Eschatocephalus*, *Aponomma*, *Amblyomma*, and *Hyalomma*. (For analytical key, see p. 385.)

Genus Ixodes[2] Latreille, 1796.

Generic diagnosis.—*Ixodinæ:* Eyes absent. Palpi long. Anal groove open or closed caudad, but tangent to the anus by its anterior concavity. Tarsi without ter-

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[1] Synonymy and Bibliography.

1844: Fam. *Ixodiden* Koch, 1844, pp. 220–234.—Idem, 1847, pp. 13–23.
1861: Fam. *Ixodides* Fürstenberg, 1861, p. 208.
1890: *Cultripalpi* Canestrini, 1890, p. 491. [See also Neumann, 1899, p. 107.]
1892: Fam. *Ixodidæ* Marx, 1892, pp. 233, 234, 235.
1892: *Hæmalastoridæ* Marx, 1892, pp. 234, 235.
1892: *Eschatocephalidæ* Marx, 1892, pp. 233, 234.
1899: Tribe *Ixodæ* Neumann, 1899, pp. 107–294.
1901: Subfam. *Ixodinæ* Salmon & Stiles, 1901, pp. 458–478.

[2] Synonymy and Bibliography.

1796: *Ixodes* Latreille, 1796, p. 179; type, *Acarus ricinus.*—Idem, 1804, pp. 46, 51–53.—Idem, 1806, pp. 155–159.—Idem, 1829, pp. 287, 288.—Fabricius, 1805, minal spurs. *Male* with ventral shields; prægenital shield between genital pore and capitulum; 2 lateral epimeral shields, more or less surrounding the coxæ and stigmata; a genito-anal shield of elongate pentagonal form between genital pore and anus; an anal shield, triangular, ogival, or circular, caudad of preceding, the anterior apex encircling the anus, the base formed by the posterior margin of the body; two adanal, quadrangular shields parallel to the anal shield. Scutum leaving an uncovered lateral and posterior margin; postero-marginal festoons absent. Stigmata oval.

Female.—With three dorsal longitudinal posterior grooves on the ventral surface; two long genital grooves extending from the vulva and diverging caudad, and two anal grooves united in front of the anus, parallel or divergent in back, rarely convergent. Stigmata circular.

Type species.—*Ixodes ricinus* (Linnæus).

This genus has been the collective group for the ticks, naturalists who were unfamiliar with the family placing in *Ixodes* any species which they believed to be new. Many of the forms are to-day unrecognizable, as they have been described on insufficient characters.

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pp. 351-356.—Chabrier (1807).—Leach, 1815, pp. 397-399.—Heyden, 1826, p. 610.—Risso, 1826, p. 182.—Burmeister, 1837, p. 579.—Koch, 1844, p. 231.—Idem, 1847, pp. 20-23.—Gervais, 1844, p. 234-251.—Idem, 1847, p. 351, 352.—Gervais & van Beneden, 1859, pp. 460, 461.—Grube, 1859, p. 455.—Fürstenberg, 1861, p. 208.—Moquin-Tandon, 1861, p. 304.—Gerstaecker, 1863, p. 344.—Lucas, 1866, p. lvii.—Verrill, 1870, pp. 116-118.—Murray, 1877, pp. 187, 190-195.—Canestrini & Fanzago, 1877, pp. 178, 179-186, 187.—Mégnin, 1880a, pp. 121-132, 320-322.—Idem, 1880b, p. 603.—Idem, 1895, p. 354.—Haller, 1882, pp. 309-311.—Berlese, 1885, p. 131.—Braun, 1883, pp. 211, 212.—Idem, 1895, p. 257.—Raymondaud (1885).—Ludwig, 1886, p. 612.—Railliet, 1886, pp. 496-499.—Idem, 1893, pp. 706-710.—Neumann, 1888, p. 89.—Idem, 1892a, pp. 92, 93-100.—Idem, 1892b, pp. 96-98.—Idem, 1897, p. 325.—Idem, 1899, pp. 108-166, 168.—Canestrini, 1890, pp. 476, 479, 482, 483, 484, 485, 486, 487, 488, 489, 490, 491, 492, 494, 530.—Idem, 1892, p. 581.—Batelli, 1891, p. 78, 79, 80.—Efisio, 1892, p. 256.—Trouessart, 1892, p. 47.—Lewis, 1892, p. 449.—Marx, 1892, pp. 232, 233, 235.—Oudemans, 1896, p. 191.—Osborn, 1896, p. 262.—Blanchard, 1890, pp. 323-329.—Morgan, 1899, p. 138.—Ward, 1900a, pp. 196, 203-204.—Idem, 1900b, p. 436.—Salmon & Stiles, 1901, pp. 459-468. [See also Kolenati, 1857, p. 24.—Conil, 1877, pp. 25, 26, 27, 28, 29.—Idem, 1878, pp. 99, 100, 101.—Trouessart, 1891, pp. 290, 291, 292, 293, 294, 295, 297, 300.—Idem, 1892, pp. 20, 33.—Neumann, 1897, p. 360, sub *Dermacentor*.—Idem, 1897, p. 384, sub *Rhipicephalus*.—Idem, 1899, p. 283, sub *Hyalomma*.]

1804: *Cynorhastes* Hermann (1804, p. 66).—Risso, 1826, p. 183.—Treviranus, 1831, p. 188. [See also Heyden, 1826, p. 610.—Gervais, 1844, pp. 234-236.—Neumann, 1888, p. 89.—Idem, 1892a, p. 93.—Idem, 1892b, p. 96.—Idem, 1899, p. 108, sub *Ixodes*.—Idem, 1899, p. 283, sub *Hyalomma*.—Canestrini, 1890, p. 482.—Railliet, 1893, p. 706, sub *Ixodes*.]

1805: "*Cynorrhastes* Herman" of Fabricius, 1805, pp. 351, 352, 353, and of Dugès, 1834c, p. 33.

1822: *Crotonus* Duméril, 1822, p. 56.—Idem, 1829, pp. 401, 402; type, *ricinus*. [See also Neumann, 1899, p. 108, as syn. of *Ixodes*.]

1829: "*Cynorasthes* Hermann" of Latreille, 1829, p. 287.

1880: "*Cynochastes* Hermann" of Mégnin, 1880, p. 121.

1891: "*Cynorhastes* Hermann" of Trouessart, 1891, p. 290.

Several species occur in America, and two of them, *Ixodes ricinus* and *I. hexagonus*, occur on American cattle. Neumann gives the following key to the species known to him:

KEY TO THE SPECIES OF THE GENUS IXODES.

[For North American forms, follow Roman type.]

Males	1
Females	9
Nymphs	35

A.—Male.

1.	Anal shield with divergent or parallel sides	2
	Anal shield with convergent sides	7
2.	Scutum covering the greater part of the back	3
	Scutum scarcely covering half of the width of the back (South America)	*I. loricatus.*
3.	Posterior margin of scutum not fimbriate	4
	Posterior margin of the scutum divided into 5 short broad segments provided with long hairs (Bering Island)	*I. fimbriatus.*
4.	Coxæ I with strong median spine	5
	Coxæ I: Median and lateral spines short and equal (Egypt)	*I. coxæfurcatus.*
5.	Tarsi without dorsal protuberance	6
	Tarsi with dorsal protuberance near the tip	*I. hexagonus*, p. 467
6.	Scutum pubescent	*I. ricinus*, p. 462
	Scutum glabrous (Japan, Amoor)	*I. ovatus.*
7.	*Anal shield open caudad*	8
	Anal shield closed caudad (Congo)	*I. rasus.*
8.	*Anal shield horseshoe-shaped* (Africa)	*I. pilosus.*
	Anal shield nearly closed caudad (Australia, India)	*I. holocyclus.*

B.—Female

9.	Anal grooves divergent or parallel	10
	Anal grooves convergent	34
10.	First palpal article short, not forming an anteriorly directed horn	11
	First palpal article forming a strong anteriorly directed horn (South America)	*I. thoracicus.*
11.	Scutum longer than broad	12
	Scutum as broad as long, or broader than long	30
12.	Sides of scutum rounded	13
	Sides of scutum straight, angular, or sinuous	25
13.	Lateral grooves of scutum more or less apparent	14
	Lateral grooves of scutum absent	21
14.	Coxæ I with one spine or with two unequal spines	15
	Coxæ I with two equal spines (South America)	*I. loricatus.*
15.	Coxæ I with strong median spine	16
	Coxæ I not prolonged in a strong median spine	17
16.	Punctations of scutum equal	18
	Punctations of scutum unequal, the larger near the margin	*I. diversifossus.*
17.	*Coxæ I with small spine at postero-lateral angle* (South America)	*I frontalis var.*
	Coxæ I without spine at postero-lateral angle (Congo)	*I. rasus.*
18.	Porose areas broader than long and close together	*I. ricinus*, p. 462
	Porose areas as long as broad, or longer, distant	19
19.	*Lateral grooves of scutum slightly apparent; punctations fine* (Japan, Amoor)	*I. ovatus.*
	Lateral grooves well marked	20

20. Tarsi with dorsal protuberance (U. S. A.?) .... ***I. dentatus.***
Tarsi without dorsal protuberance (Ecuador) .... ***I. fossulatus.***
21. *Scutum with unequal punctations, the largest near posterior border* (Costa Rican Felis pardalis) .... ***I. affinis.***
Scutum with equal punctations 22
22. *Punctations on shield very fine, close together* 23
Punctations large, distant 24
23. *Body provided with granulations* (Madeira Islands) .... ***I. obscurus.***
Body not provided with granulations (New Zealand) .... ***I. praecoxalis.***
24. Coxæ I with two subequal spines .... ***I. bifurcatus.***
Coxæ I with one long spine (Sumatra) .... ***I. spinicoxalis.***
25. Coxæ I provided with spines or tuberosities 26
Coxæ I smooth (British Columbia, Alaska, Cape Horn) .... ***I. putus.***
26. *Coxæ I with two small posterior tuberosities* (New Zealand) .... ***I. eudyptidis.***
Coxæ I spinose 27
27. Coxæ I unicuspid 28
Coxæ I bicuspid 29
28. Spine on coxæ I long, at postero-median angle .... ***I. hexagonus,*** p. 467
Spine on coxæ I short, at postero-lateral angle (New Zealand) .... ***I. intermedius.***
29. Scutum without lateral grooves. Porose areas rounded .... ***I. frontalis.***
Scutum with lateral grooves. Porose areas triangular .... ***I. angustus.***
30. *Scutum considerably broader than long* (Tasmania, Mariana Is.). ***I. ornithorhynchi.***
Scutum as broad as long or scarcely broader than long 31
31. *Coxæ I unarmed* (Tasmania) .... ***I. Tasmani.***
Coxæ I armed 32
32. *Coxæ I unicuspid* 33
Coxæ I bicuspid (Sikhim? Sikkim) .... ***I. lævis.***
33. *Coxæ I with short spine* (Africa) .... ***I. luteus.***
Coxæ I with long spine (Brazil) .... ***I. spinosus.***
34. *Anal grooves distant posteriorly* (Africa) .... ***I. pilosus.***
Anal grooves reunited in a point posteriorly (Australia, India) .... ***I. holocyclus.***

C.—*Nymph.*

35. Scutum longer than broad 36
Scutum as broad as long or broader 41
36. Anal grooves separated posteriorly 37
Anal grooves reunited in a point posteriorly (Australia, India) .... ***I. holocyclus.***
37. Tarsi without protuberance near the extremity 38
Tarsi with protuberance near the extremity .... ***I. hexagonus,*** p. 467
38. Scutum with lateral grooves 39
Scutum without lateral grooves (British Columbia, Alaska, Cape Horn) .. ***I. putus.***
39. Scutum short oval 40
Scutum elongate oval, sides almost straight (South America) .... ***I. loricatus.***
40. Hypostome with three rows of denticles on each half .... ***I. ricinus,*** p. 462
Hypostome with two rows of denticles on each half (Brazil) .... ***I. imperfectus.***
41. *Scutum rounded* 42
Scutum cordiform, considerably broader than long (Tasmania, Mariana Is.)
I. ornithorhynchi.
42. *Coxa I provided with a long spine* (Brazil) .... ***I. spinosus.***
Coxa I with simple tuberosity (New Grenada) .... ***I. jurenus.***

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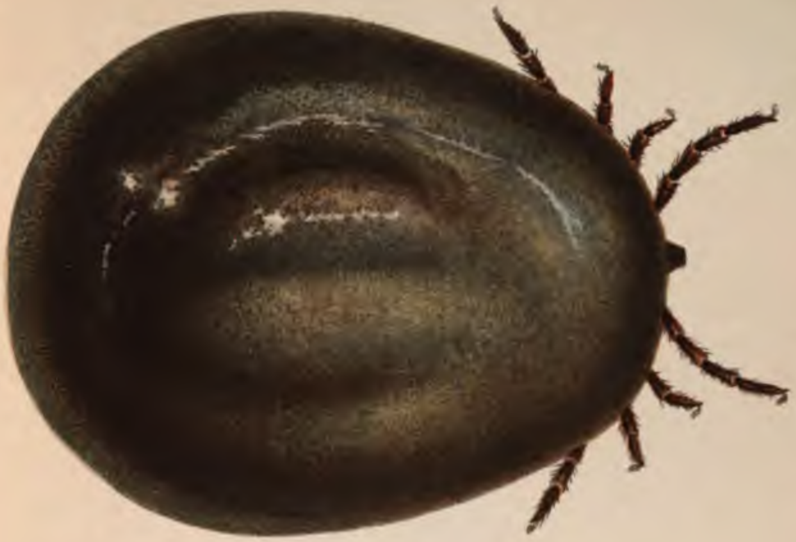

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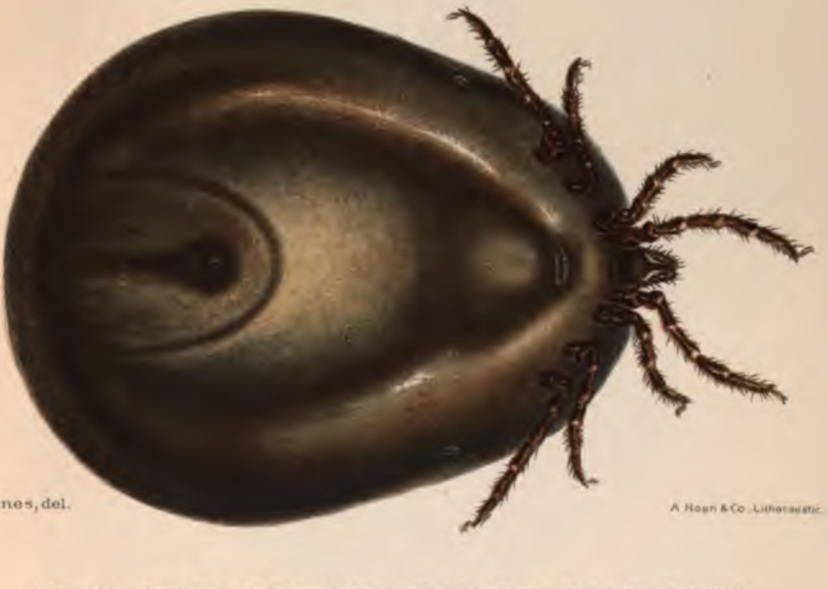
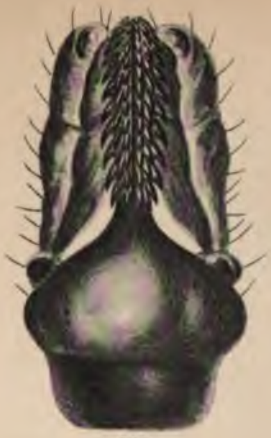


Haines, del.

A Hoen & Co. Lithocaustic.

FIG. 223. DORSAL VIEW OF IXODES RICINUS. GREATLY ENLARGED. ORIGINAL.
B. A. I., 3141, FROM CATTLE; RICHMOND, VA.

FIG. 224. VENTRAL VIEW OF SAME.



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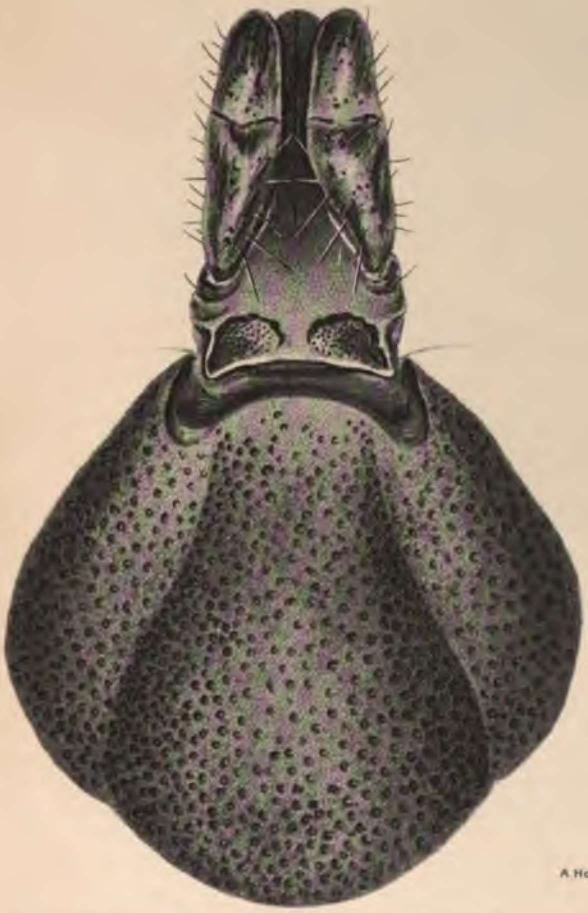

Haines, del.

A Hoen & Co. Lithocaustic.

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FIG. 225. VENTRAL VIEW OF CAPITULUM OF IXODES RICINUS.

FIG. 226. DORSAL VIEW OF SCUTUM AND CAPITULUM OF FEMALE IXODES RICINUS.

The Castor-Bean Tick (*Ixodes ricinus*).[1]

(Figures 222-227.)

Specific diagnosis.—*Ixodes: Male.*—Body oval, with broader posterior border, rounded, entire; 2.5 mm. long (including capitulum), 1.5 mm. broad; deep red brown on all parts. Scutum convex, covering entire dorsal surface, except a clearer narrow marginal swelling; punctations very fine and abundant; cervical grooves very superficial. Genital orifice broad, on plane of coxæ III. Pregenital shield a third longer than broad, narrower and rounded or sinuous in front, with convex sides. Anal shield a little longer than broad, ogival, sides straight and divergent. Anus same as in female. Very apparent hairs scattered on entire surface; those of the epimeral shields having their insertions reinforced by punctiform thickenings. Capitulum 500 μ long, its base twice as broad as long and of trapeze form, open in front on the dorsal surface, a little longer than broad on the ventral surface, which has the same form as in the female. Mandibles 750 μ long, digit 180 μ long; the sheath of the stem simply corrugated transversely; internal apophysis of the digit applied against the dorsal face of the anterior half; with three points, an anterior terminal, small, one which follows immediately, larger, and a basal, feeble; the broad base not extending beyond the middle of the length of the digit; external apophysis with seven or eight teeth, the anterior progressively larger and forming a comb or crest, the posterior basal very strong. Hypostome bearing on each side a marginal series of six to eight teeth, increasing in strength from before backward;

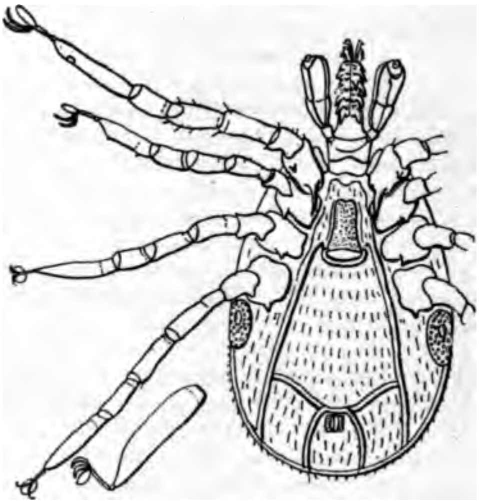

Fig. 222.—Male *Ixodes ricinus*. Ventral view. After Neumann, from Railliet, 1893, p. 707, fig. 481.

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[1] Synonymy and Bibliography.

1758: *Acarus reduvius* Linnæus, 1758, p. 615, and 1760, p. 615 [in part only; chiefly *Melophagus ovinus*]; not 1761, p. 479 [=*Acarus ovinus*, 1746, p. 346; *Reduvius*, or sheep's tick Charleton, 1668, p. 49; *Pediculus ovinus* Ray, 1710, p. 9; Schaf-Laus Fritsch, 1724, pp. 40, 41, Tab. xviii, figs. 1, 2.].—De Geer, 1778 pp. 101-106.—Fabricius, 1794, p. 425.—Jördens, 1801, pp. 194, 195, Tab. vii, figs. 7-9. [Given as syn. of *Ixodes reduvius* by Latreille, 1804, p. 51.—Gervais, 1844, p. 237.—Canestrini & Fanzago, 1877, p. 180.—Railliet, 1893, p. 706.—Neumann, 1899, p. 112.] [See also Dugès, 1834c, p. 33.—Latreille, 1829, p. 288.] [Given as syn. of *Ixodes ricinus* by Moquin-Tandon, 1861, p. 302, and of *Ixodes reticulatus*, p. 303.]

1758: *Acarus ricinus* Linnæus, 1758, p. 615; 1760, p. 615; 1761, pp. 479, 480 [*Ricinus* Charleton, 1668, pp. 49, 50; *Ricinus octopodus*, the tick of Ray, 1710, p. 10; Hund-Laus, Zæcken, Tæcken of Fritsch, 1724, p. 41, Tab. xix].—Fabricius, 1794, p. 425.—Dunglison, 1900, p. 7. [Given as syn. of *Ixodes ricinus* by Latreille, 1804, p. 51.—Idem, 1829, p. 288.—Fabricius, 1805, p. 351.—Leach, 1815, p. 397.—Gervais, 1844, p. 236.—Moquin-Tandon, 1861, p. 302.—Canestrini & Fanzago, 1877, p. 180.—Blanchard, 1890, p. 324.]

on ventral surface teeth are reduced to simple transverse crenulation. Palpi 450 μ long (70 μ, 180 μ, 200 μ, from first to third), similar to those of female, but relatively shorter and broader. Legs relatively longer and stronger, coxæ almost contiguous.

Female.—Young: Body flat, contour oval, much broader and rounded posteriorly, yellowish red; long, whitish hairs on both dorsal and ventral surface; 4 mm. long by 3 mm. broad.

[See also Gervais, 1844, p. 237; Railliet, 1893, p. 706, and Neumann, 1899, p. 112, as syn. of *Ixodes reduvius.*]

1778: *Acarus ricinoides* De Geer, 1778, pp. 98–101, pl. v, figs. 16, 17; *Acarus ricinus* Linnæus, renamed. [See also Jördens, 1801, p. 199.—Gervais, 1844, p. 236.—Canestrini & Fanzago, 1877, p. 180.—Oudemans, 1896, p. 191, and Neumann, 1899, p. 112, as syn. of *Ixodes reduvius.*]

1804: *Ixodes ricinus* (Linnæus) Latreille, 1804, p. 51.—Idem, 1806, p. 156.—Heyden, 1826, p. 610.—Idem, 1829, p. 288.—Fabricius, 1805, p. 351.—Illiger, 1807, p. 370.—Leach, 1815, pp. 397, 398.—Müller, 1817, pp. 278–287.—Treviranus, 1831, p. 191.—Gervais, 1844, p. 236.—Koch, 1844, pp. 231, 232.—Idem, 1847, pp. 20, 21.—Siebold, 1850, p. 659.—Küchenmeister, 1855, p. 422.—Milner, 1858, pp. 6, 13.—Gervais & van Beneden, 1859, p. 461.—Moquin-Tandon, 1861, p. 302.—Gerstaecker, 1863, p. 344.—Packard, 1869, p. 663.—Wagner, 1876, p. 129.—Conil, 1877, pp. 26, 27, 28.—Idem, 1878, p. 100.—Murray, 1877, pp. 190, 193.—Cobbold, 1879, p. 267.—Haller, 1880, p. 38.—Idem, 1882, pp. 309, 310, Taf. v, fig. 4.—Oudemans, 1880, p. xvii.—Idem, 1896, pp. 191, 192, 194.—Johannessen, 1885, p. 401.—Ludwig, 1886, p. 612.—Railliet, 1886, pp. 497, 498, fig. 348.—Braun, 1883, pp. 211, 212, 231, figs. 55, 56.—Idem, 1895, p. 257, figs. 127, 128.—Neumann, 1888, pp. 90, 91, fig. 47.—Idem, 1892a, pp. 95, 96, figs. 53, 55.—Idem, 1892b, pp. 98, 99, fig. 55.—Blanchard, 1890, pp. 324–326, figs. 592–594.—Idem, 1891, pp. 689–691.—Efisio, 1892, pp. 256, 257.—Janson & Tokishige, 1892, p. 349.—Mosler & Peiper, 1894, pp. 320, 321, fig. 110.—Osborn, 1896, p. 262, fig. 155.—Schneidemühl, 1896, p. 339.—Wood & Fitz, 1897, p. 346.—Weichselbaum, 1898, p. 325.—Niles, 1898a, pp. 45, 46.—Idem, 1898b, pp. 29, 30, pl. iv, figs. 3–6.—Morgan, 1899, pp. 129, 133, 134, 140, 141, pls. vii–viii, ? ix, figs. 1–5.—Mosso, 1899, p. 20.—Dunglison, 1900, pp. 596, 1093.—Salmon & Stiles, 1901, pp. 462–466, figs. 222–227. [Given as syn. of *Ixodes reduvius* by Canestrini & Fanzago, 1877, pp. 180, 184.—Canestrini, 1890, pp. 497, 498.—Railliet, 1893, p. 706.—Neumann, 1899, p. 112.—Ward, 1900b, p. 436.]

1804: *Cynorhæstes reduvius* (Linnæus) Hermann (1804), pp. 65, 66. [See also Canestrini & Fanzago, 1877, p. 180, and Neumann, 1899, p. 112, as syn. of *Ixodes reduvius.*] [See also Gervais, 1844, p. 236, as syn. of *Ixodes ricinus.*]

1804: *Cynorhæstes ricinus* (Linnæus) Hermann (1804), pp. 65, 66. [See also Canestrini & Fanzago, 1877, p. 180, and Neumann, 1899, p. 112, as syn. of *Ixodes reduvius.*]

1804: *Ixodes reduvius* (Linnæus) Latreille, 1804, pp. 51, 52.—Hahn, 1834, p. 62, fig. 152.—Gervais, 1844, pp. 237-239.—Koch, 1844, p. 232.—Idem, 1847, p. 21.—Verrill, 1870, p. 118.—Conil, 1877, pp. 26, 27.—Canestrini & Fanzago, 1877, pp. 179, 180, 184.—Murray, 1877, p. 193.—Cobbold, 1879, p. 350.—Mégnin, 1880, pp. 127-129.—Aurivillius, 1886, p. 106.—Railliet, 1886, pp. 498, 499.—Idem, 1893, pp. 706–709, figs. 480–483.—Neumann, 1888, pp. 91, 92.—Idem, 1892a, pp. 96, 97.—Idem, 1892b, pp. 99, 100.—Idem, 1899, pp. 109, 110, 111, 112–116, 120, 130, 131, 132, 156, 157, fig. 1.—Canestrini, 1890, pp. 478, 480, 489, 494–499, Tav. xliii, fig. 1; pp. 500, 502, 503, 506, 509, 532.—Blanchard, 1890, p. 327, fig. 595.—Batelli, 1891, pp. 78, 84, 99.—Osborn, 1896, p. 262.—Ward, 1900a, pp. 203, 204.—Idem, 1900b, p. 436.

Fecundated and replete female resembles a slightly depressed castor-oil bean, attains 10 to 11 mm. long by 6 to 7 mm. broad, is of ashy color, passing sometimes into the black, brown, or yellow; scutum, capitulum, and legs a shining dark brown. Scutum deep chestnut brown, oval-subpentagonal, with salient lateral borders, posterior angle rounded, anterior border slightly emarginate to receive the base of the

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[See also Kolenati, 1857, p. 24, as syn. of *Ixodes holsatus.*] [See also Neumann, 1899, p. 129, as syn. of *Ixodes hexagonus.*]

1805: "*Cynorrhæstes reduvius* Hermann," 1804, of Fabricius, 1805, p. 351, as syn. of *Ixodes ricinus.*

1805: "*Cynorrhæstes ricinus* Hermann," 1804, of Fabricius, 1805, p. 352, as syn. of *Ixodes vulgaris.*

1805: *Ixodes vulgaris* Fabricius, 1805, p. 352 [*Acarus reduvius* Linn., renamed].

1805: "*Acaruus reduvius*" Linnæus of Fabricius, 1805, p. 352, as syn. of *Ixodes vulgaris.*

1815: *Ixodes megathyreus* Leach, 1815, p. 398; hosts, dogs and *Erinaceus europæus.*—Risso, 1826, p. 182.—Gervais, 1844, p. 240.—Koch, 1844, p. 234.—Idem, 1847, p. 23.—Neumann, 1888, p. 93.—Idem, 1892a, p. 98.—Idem, 1892b, p. 101. [See also Oudemans, 1896, p. 191, and Neumann, 1899, p. 112, as syn. of *Ixodes reduvius.*]

1826: *Ixodes bipunctatus* Risso, 1826, p. 183.—Gervais, 1844, p. 241. [See also Canestrini & Fanzago, 1877, p. 180; Oudemans, 1896, p. 191, and Neumann, 1899, p. 112, as syn. of *Ixodes reduvius.*—Neumann, 1896, p. 158, as nominal species.]

1826: *Cynorhæstes Hermani* Risso, 1826, pp. 183, 184. [See also Canestrini & Fanzago, 1877, p. 180 [*C. Hermani*]; Oudemans, 1896, p. 191, and Neumann, 1899, p. 112, as syn. of *Ixodes reduvius.*]

1826: *Cynorhæstes megathyreus* (Leach) Risso (1826, p.—). [See also Canestrini & Fanzago, 1877, p. 180, as syn. of *Ixodes reduvius.*]

1829: *Crotonus ricinus* (Linnæus) Duméril, 1829, pp. 401, 402. [See also Neumann, 1899, p. 112, as syn. of *Ixodes reduvius.*]

1832: "*Chinorhæstes ricinus*" (Linnæus) Hermann of Audouin, 1832, p. 423.

1832: *Ixodes trabeatus* Audouin, 1832, pp. 420–422, pl. xiv, fig. 3 a–n.—Gervais, 1844, pp. 241, 242.—Dolly, 1894, p. 1000. [See also Oudemans, 1896, p. 191, and Neumann, 1899, p. 112, as syn. of *Ixodes reduvius.*]

1834: *Ixodes plumbeus* Dugès, 1834a, p. 20.—Idem, 1834c, pp. 33–36, pl. vii, figs. 7–12; renamed *Ixodes Dugesii* by P. Gervais. [See also *Ixodes plumbeus* (Fabricius, 1794) Fabricius, 1805, p. 353.—Neumann, 1899, p. 112, as syn. of *Ixodes reduvius.*—Osborn, 1896, p. 257, as syn. of *Boophilus bovis.*] [Not *Ixodes plumbeus* Panzer (1795, Heft 90, No. 32.).—Koch, 1844, p. 234.—Idem, 1847, p. 23.] [Not *Ixodes plumbeus* Leach, 1815, p. 397; renamed *Ixodes lividus* Koch, 1844, p. 234.—Idem, 1847, p. 23.]

1835: *Ixodes fuscus* Koch (1835), Heft 39, figs. 3, 4.—Idem, 1844, p. 232.—Idem, 1847, p. 21.—Canestrini & Fanzago, 1877, p. 184. [See also Oudemans, 1896, p. 191, and Neumann, 1899, p. 112, as syn. of *Ixodes reduvius.*] [See *Ixodes fuscous* (Say, 1821, p. —)="*I. fuscus* Say" of Gervais, 1847, p. 352, and Neumann, 1899, p. 165.]

1835: *Ixodes lacertæ* Koch (1835), Heft 37, figs. 5–7; Heft 39, fig. 11.—Idem, 1844, p. 234.—Idem, 1847, p. 22. [See also Neumann, 1899, p. 112, as syn. of *Ixodes reduvius.*]

1866: *Ixodes pustularum* Mégnin MS. in Lucas, 1866, p. lvii; France. [Renamed *Ixodes fodiens* by Mégnin, 1867.] [See also Murray, 1877, pp. 191, 192, and Dolly, 1894, p. 1000, as syn. of *Ixodes fodiens.*—Neumann, 1899, p. 113, as syn. of *Ixodes reduvius.*]

1867: *Ixodes fodiens* Mégnin, 1867, p. 107.—Murray, 1877, pp. 191, 192, figs. 2. [See capitulum; shield extending in young specimens to the middle of the dorsal surface, relatively small in replete specimens; cervical grooves superficial; punctations fine and equal, and uniformly distributed; a few short sparse whitish hairs. Tegument covered with fine short hairs. On dorsal surface two short anterior grooves, slightly divergent; three posterior grooves: One median, straight; two lateral, concave toward median line. Genital pore at height of coxæ IV; genital grooves united in front of the vulva, and divergent caudad; two ano-marginal grooves united in an ellipse in front of the anus, divergent caudad. Anus provided with three hairs on each lip. Stigmata whitish in the young, reddish later, stigmal plate finely punctate, stigmal pore small. Capitulum 800 μ long (from postero-dorsal margin to tip of the hypostome), base elongate reniform, twice as broad as long on its dorsal surface; ventral

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also Neumann, 1899, p. 113, as syn. of *Ixodes reduvius*.—Dolly, 1894, p. 1000, as syn. of *I. pustularum*.]

Oudemans, 1896, pp. 191, 192, 194, gives also the following species as synonyms of *Ixodes ricinus:*

1758: *Pediculus cervi* Linnæus, 1758, p. 611.
? : *Acarus cardinalis* Pallas.
1794: *Acarus lipsiensis* Fabricius, 1794, p. 427=*Ixodes lipsiensis* (Fabricius) Fabricius, 1805, p. 354.—Koch, 1844, p. 234.—Idem, 1847, p. 23.—Conil, 1877, p. 27. [Given by Neumann, 1899, p. 156, as syn. of *Ixodes reduvius* or *Ixodes hexagonus*.] [See also Latreille, 1804, p. 51, as syn. of *Ixodes ricinus*, and Fabricius, 1805, p. 354, as syn. of *Ixodes lipsiensis*.]
1794: *Acarus sanguisugus* of Fabricius, 1794, p. 426=*Ixodes sanguisugus* (Linnæus) Fabricius, 1805, p. 353. [*Acarus sanguisugus* Linnæus, 1758, p. 615=*Amblyomma sanguisugum* (Linnæus) Koch, 1844, p. 230.—Idem, 1847, p. 19; unidentifiable according to Neumann, 1899, p. 283.] [See also Latreille, 1804, p. 51, as syn. of *Ixodes ricinus*.] [See also Jördens, 1801, p. 198.]
1794: *Acarus pallipes* Fabricius, 1794, p. 426=*Ixodes pallipes* (Fabricius) Fabricius, 1805, p. 352.—Koch, 1835, Heft 39, No. 10.—Idem, 1844, p. 234.—Idem, 1847, p. 22.—Conil, 1877, p. 27. [See also *Ixodes pallipes* Lucas—Gervais, 1844, p. 243.] [See also Neumann, 1899, pp. 133, 135, as syn. of *I. frontalis*.]
? : *Acarus hirudo* Fabricius, given as unidentified by Neumann, 1899, p. 166. [See also Jördens, 1801, p. 195.]
1794: *Acarus holsatus* Fabricius, 1794, p. 428=*Ixodes holsatus* (Fabricius) Fabricius, 1805, p. 355.—Koch, 1844, p. 234.—Idem, 1847, p. 23.—Conil, 1877, p. 27; given as syn. of *Ixodes reduvius* or *Ixodes hexagonus* by Neumann, 1899, p. 157. [See also Latreille, 1804, p. 51, as syn. of *Ixodes ricinus* and Fabricius, 1805, p. 355, as syn. of *Ixodes holsatus*.]
1795: *Acarus tristriatus* Panzer (1795, fasc. 59, fig. 24)=*Ixodes tristriatus* (Panzer) Koch, 1844, p. 234.—Idem, 1847, p. 23; given by Neumann, 1899, p. 157, as syn. of *Ixodes reduvius* or *Ixodes hexagonus*.
? : *Ixodes variegatus* Müller? [See also *Ixodes variegatus* (Fabricius, 179- ?) Fabricius, 1805, p. 353.]
? : *Ixodes marginalis* Hahn. [See also *Ixodes marginalis* in Gervais, 1844, p. 242.]
1837: *Ixodes marginatus* Burmeister, 1837, p. 579. [See also *Ixodes marginatus* (Fabricius, 1794) Fabricius, 1805, p. 354.]
1835: *Ixodes sciuri* Koch, 1835, Heft 5, No. 11; Heft 37, No. 8.—Idem, 1844, p. 232.—Idem, 1847, p. 21. [See Neumann, 1899, p. 156, as syn. of *Ixodes reduvius* or *I. hexagonus*.]
1844: "*Ixodes marmoratus* Gervais," 1844, p. 241=["*Ixodes marmoratus* Risso," 1826, pp. 182, 183, given as syn. of *Ixodes reduvius* by Canestrini & Fanzago, 1877, p. 180.]
? : *Ixodes ricinus* Gervais?—Verrill, 1870, p. 118.
? : *Ixodes talpæ* Doles.
1877: *Ixodes erinaceus* Murray, 1877 (see below, p. 468, under *Ixodes hexagonus*).
1880: "*Ixodes bovis* Riley" of Oudemans, 1880, p. xvii.

surface pentagonal, as broad in front as long, summit anterior, lateral borders convergent in back. Porose areas elongate transversely. Mandibles 1.5 mm. long, digit 150 μ, the sheath of the stem very shagreened, granular. Internal apophysis of digit elongate, with two retrograde teeth, one terminal, the other on the middle of the length, with a long stem of insertion terminated toward the posterior fourth of the digit; external apophysis with 5 teeth, increasing in size from the anterior to the posterior, the latter being strong. Hypostome elongate, lanceolate, provided on each half, besides the small teeth at the summit, with three more or less regular rows of well developed teeth: One row lateral and marginal, with strong, sharp teeth, the anterior and posterior smaller; one intermediate, with smaller teeth; and a median row scarcely extending beyond the anterior half. Palpi 800 μ long (100 μ, 360 μ, 340 μ, from first to third), digits depressed dorso-ventrally, dorsal surface flat, ventral surface excavate in an internal bevel; dorsal surface provided with sparse hairs, in a series on the median border of the ventral marginal thickness. Legs thin. Coxæ elongate, contiguous in the young, slightly separated in the replete; coxæ I prolonged on their postero-median angle by a strong spine, which strikes against coxæ II. All the articles provided with stiff hairs. Tarsi long and thin, forming, especially tarsi I, nearly a third of the length of the leg, attenuate gradually without protuberance; pulvillum nearly as long as the nails.

Nymphs and larvæ have a capitulum which recalls that of the female.

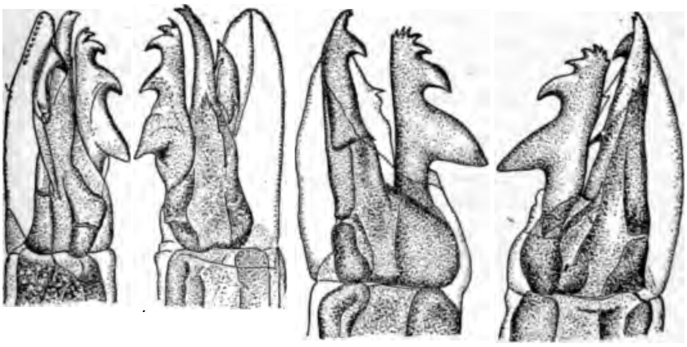

FIG. 227.—Dorsal and ventral views of digit of mandible of male and of female *Ixodes ricinus*. X 195. After Neumann, 1899, p. 114, fig. 1.

The above description is taken almost verbatim from Neumann, who has all of our specimens of this tick with the exception of a few females.

The castor-bean tick is reported from sheep, goats, cattle, horses, deer, dogs, cats, fox ferrets, hedgehogs, hares, rabbits, bats, birds, and various other animals, including man. It is found in Europe, North Africa, and North America, and it is one of the oldest and most commonly known ticks.

EUROPEAN DOG TICK (*Ixodes hexagonus*).[1]

(Figures 228–235.)

SPECIFIC DIAGNOSIS.—*Ixodes: Male.*—Body elliptical, almost as broad anteriorly as posteriorly; length 3.5 to 4 mm., breadth 2 to 2.5 mm. Brown red, legs lighter.

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[1] SYNONYMY AND BIBLIOGRAPHY.

1815: *Ixodes hexagonus* LEACH, 1815, p. 397; type host, *Erinaceus europæus*, England.—GERVAIS, 1844, p. 240.—KOCH, 1844, p. 234.—IDEM, 1847, p. 23.—CANESTRINI, Scutum covering the entire dorsal surface, except a narrow margin, lighter and elevated in a swelling; pierced all over with punctiform depressions, in the center of each of which a very short hair is inserted. The genital pore opposite the intercoxal space between coxæ II and III. Pregenital shield a little broader than long, narrowed posteriorly into a narrow base, rectangular, anteriorly very much widened and sinuous. Anal shield ogival, sides slightly divergent, almost twice as long as broad. Epimeral shields reinforced laterally by chitinous plates, toward the median line by punctations of the same kind bearing hairs. The entire ventral surface provided with fine hairs. Anus like that of the female. Capitulum 520 μ long (from its dorsal border to the tip of the hypostome), at the base almost twice as broad as long on its dorsal surface, which is almost rectangular, a little longer than broad on its ventral surface, which is also almost rectangular. Mandibles with digit 165 μ long; sheath and denticles of mandibles as in male *Ixodes ricinus*. Hypostome and palpi like those of male *Ixodes ricinus*, except that the lateral denticles of the former are half as strong, the ventral crenulations more marked, each formed by three denticles united at the extremities of their base. Legs like those of the female, relatively longer and stronger, coxæ nearly contiguous, the retrograde spine of the first pair stronger, but a little less so than that of the male of *Ixodes ricinus*.

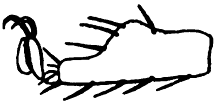

FIG. 229.—Tarsus IV of *I. hexagonus*. X 60. After Neumann, from Railliet, 1893, p. 710, fig. 485.

Female.—Like that of *Ixodes ricinus*, except for the following differences: Scutum less oval, more lozenge-shaped, with lateral angles more pronounced, the sides a little excavate in their posterior half, the posterior angle narrower; punctations larger. In young specimens the dorsal surface has a marginal groove rather distant from the margin; this presents posteriorly four small indentations formed by the prolonging of the ventral grooves. Genital pore at height of last intercoxal space. Anus more anterior; ano-marginal grooves longer, united in a point (ogival) anterior of the anus. Capitulum shorter (700 μ); mandibles with digit 160 μ long; hypostome a little shorter, with lateral denticles less salient, the median row very short, reduced to three or four anterior denticles; palpi shorter, the third article almost as long as the second. Legs relatively shorter, thicker, especially the tarsi; coxæ I with retrograde tooth less strong shorter; tarsi thick, short, swollen toward the extremity, which is preceded by a very salient gibbosity; pulvillum attains almost the middle of the length of the claws.

As Neumann has all of our specimens of this form, we have taken his diagnosis almost verbatim. This tick is reported both from the United States and from Europe, and has been found on dogs, cattle,

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1890, pp. 481, 489, 498, 499, 500, Tav. XLIII, fig. 2.—Batelli, 1891, pp. 78, 81, 98.—Railliet, 1893, pp. 709, 710, fig. 485.—Neumann, 1899a, pp. 109, 110, 111, 129–132, 156, 161, fig. 10.—Idem, 1899b, pp. 464–465.—Ward, 1900a, p. 204, fig. 1.—Idem, 1900b, p. 436, fig. 257.—Salmon & Stiles, 1901, pp. 467, 468, figs. 228–235.

1815: *Ixodes autumnalis* Leach, 1815, p. 398; type host, *Canis familiaris*, England.—Gervais & van Beneden, 1859, p. 461. [See also Neumann, 1899, p. 129, as syn. of *I. hexagonus*.]

1832: *Ixodes erinacei* Audouin, 1832, pp. 415–419, pl. XIV, fig. 2 *a–u;* type host, *Erinaceus*.—Gervais, 1844, p. 242.—Haller, 1882, pp. 310, 311.—Batelli, 1891, p. 98. [See also Canestrini, 1890, p. 500, and Neumann, 1899, p. 129, as syn. of *I. hexagonus*.—Murray, 1877, p. 190, renamed *I. erinaceus*.]

1832: "*I. reduvius* Linnaeus" of Audouin, 1832, p. 422, pl. XIV, fig. 4. [See also Neumann, 1899, p. 129, as syn. of *I. hexagonus*.]

1837: *Ixodes sexpunctatus* Koch (1837), Heft 39, figs. 5, 6.—Idem, 1844, p. 233.—Idem,

PLATE XCV.

FIG. 228.—Male *Ixodes hexagonus.* Ventral view. After Neumann, 1899, p. 130, fig. 10.

FIG. 230.—Female *I. hexagonus.* Natural size. After Berlese, 1892, fasc. 61 (10).

FIG. 231.—The same enlarged. After Berlese, 1892, fasc. 61 (10), fig. 1.

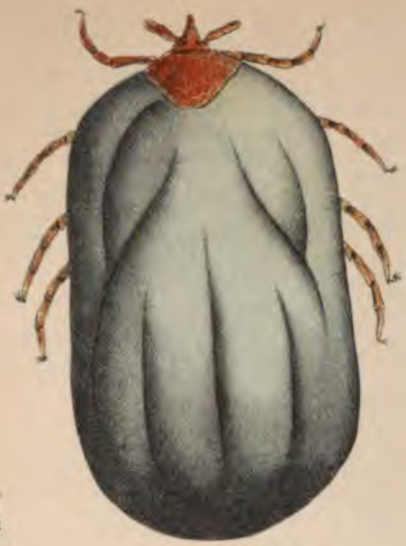
FIG. 232.—Ventral view, in outline. After Berlese, 1892, fasc. 61 (10), fig. 2.

FIG. 233.—Capitulum of same. After Berlese, 1892, fasc. 61 (10), fig. 3.

FIG. 234.—Scutum of same. After Berlese, 1892, fasc. 61 (10), fig. 4.

FIG. 235.—Stigmen of same. After Berlese, 1892, fasc. 61 (10), fig. 5.

PLATE XCV.



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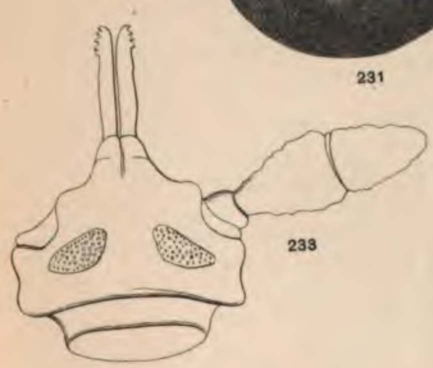

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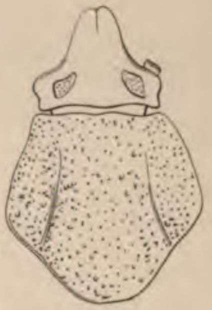

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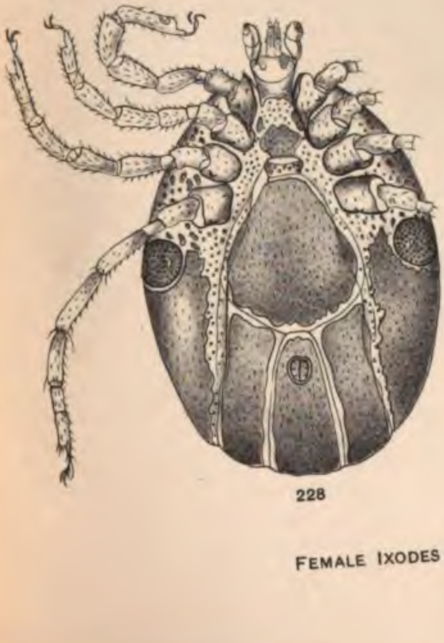

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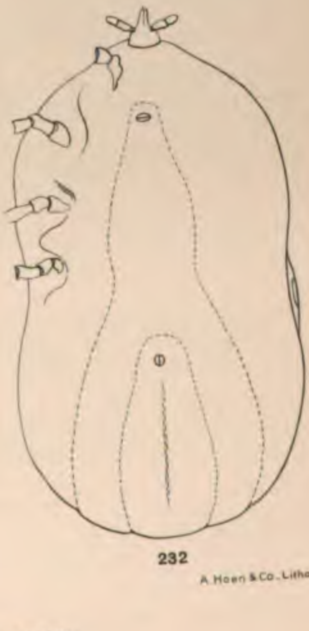

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FEMALE IXODES HEXAGONUS.

sheep, foxes, hares, squirrels, porcupines, gophers, cats, and various other hosts, including man, and several kinds of birds.

Genus Eschatocephalus[1] Frauenfeld, 1853.

Generic diagnosis.—*Ixodinæ:* Capitulum long. Palpi pyriform (male), claviform (female). Eyes wanting. Anal groove surrounding anus in front and opening caudad. Stigmata circular in both sexes. Dorsal and ventral irregular chitinous thickenings in the male; striæ or very fine parallel grooves in the female. Legs ordinarily long.

Type species.—*Eschatocephalus gracilipes* = *vespertilionis.*

Neumann mentions seven species of this genus, but none of them appear to have been reported for North America.

Genus Aponomma[2] Neumann, 1899.

Generic diagnosis.—*Ixodinæ:* Eyes wanting. Base of capitulum usually pentagonal, the dorso-lateral border very short. Palpi long. Male as broad or nearly as

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1847, p. 22. [See also Canestrini, 1890, p. 500, and Railliet, 1893, p. 709, as syn. of *I. hexagonus.*—Neumann, 1899, p. 156, as probable syn. of *I. reduvius* or *I. hexagonus.*]

1837: ?*Ixodes crenulatus* Koch (1837), Heft 39, figs. 5, 6.—Idem, 1844, p. 233.—Idem, 1847, p. 22.—Canestrini & Fanzago, 1877, pp. 184, 185. [See also Neumann, 1899, pp. 129, 132, as doubtful syn. of *I. hexagonus.*]

1861: *Ixodes vulpis* Pagenstecher (1861), II, p. 40, pl. 1, figs. 12–13.—Conil, 1877, p. 28. [See also Canestrini, 1890, p. 498.—Railliet, 1893, p. 709.—Neumann, 1899, p. 129, as syn. of *I. hexagonus.*]

1877: *Ixodes erinaceus* Murray, 1877, p. 190, figs. 3, p. 195 (*Ixodes erinacei* Audouin, renamed).—Dolly, 1894, p. 1000.—Osborn, 1896, p. 262. [See also Oudemans, 1896, p. 191, as syn. of *Ixodes ricinus*, and Neumann, 1899, pp. 129, 161, as syn. of *I. hexagonus.*]

1880: "*Ixodes ricinus* Linnæus" of Mégnin, 1880a, p. 129. [See also Canestrini, 1890, p. 498.—Railliet, 1893, p. 709.—Neumann, 1899, p. 129, as syn. of *I. hexagonus.*]

1893: "*Ionus hegxa* Leach" of Railliet, 1893, p. 709 (misprint for *I. hexagonus*).

[1] Synonymy and Bibliography.

1853: *Eschatocephalus* Frauenfeld, 1853, pp. 54–58; type, *gracilipes.*—Marx, 1892, pp. 233, 234.--Morgan, 1899, pp. 136, 137. [See also Neumann, 1899, pp. 166, 167, 168, 172, as syn. of *Hæmalastor.*]

1857: *Sarconissus* Kolenati, 1857, pp. 21–23.—Idem (1860, p. 537); type, *flavipes*= *E. gracilipes*=*E. vespertilionis.*—[See also Canestrini, 1890, p. 480.]

1857: "*Hæmalastor* Koch" of Kolenati, 1857, p. 23.—Neumann, 1897, p. 325.—Idem, 1899, pp. 107, 108, 166–180.

1877: "*Sarconyssus* Kolenati" of Murray, 1877, p. 195.—Marx, 1892, p. 235.—Morgan, 1899, p. 138. [See also Neumann, 1899, pp. 166, 167, 168, as syn. of *Hæmalastor.*]

[2] Synonymy and Bibliography.

1877: *Ophiodes* Murray, 1877, pp. 203, 204; type, *Gervaisii.* [Not *Ophiodes* Wagl., 1841, rept.; Hart, 1852, hym.; Hincks, 1866, coel.] [See also Neumann, 1899, p. 180, renamed *Aponomma.*]

1899: *Aponomma* Neumann, 1899, pp. 107, 108, 109, 180–200. [*Ophiodes* Murray, renamed.]—Salmon & Stiles, 1901, pp. 469, 470.

broad as long; ventral surface naked, sexual grooves very divergent caudad, anal groove semicircular or ogival, opening in front, uniting the sexual grooves; anomarginal grooves single. Scutum covering entire dorsal surface and usually marked with metallic green spots. Stigmata comma-shaped. Female with scutum shorter than broad or scarcely longer than broad, usually marked with three metallic green spots arranged in a triangle. Ventral grooves as in male. Stigmata shorter, less attenuate at postero-lateral extremity.

TYPE SPECIES.—*Aponomma Gervaisi.*

The members of this genus live almost exclusively on reptiles. None of the forms thus far reported appear to be North American. Neumann gives the following key to the species:

KEY TO THE SPECIES OF THE GENUS APONOMMA.

Males 1
Females 8

A.—Male.

1. *Scutum marked with green metallic spots* 2
Scutum not marked with green metallic spots 3
2. *Said spots five in number* .... *A. Gervaisi.*
Said spots nine in number .... *A. exornatum.*
3. *Scutum without deep marginal groove* 4
Scutum with deep marginal groove 6
4. *Scutum channeled by fossettes; body broader than long* .... *A. transversale.*
Scutum level; body as long as broad or longer 5
5. *Tarsi II to IV narrowed at the extremity* .... *A. læve.*
Tarsi II to IV provided with tuberosity at extremity .... *A. politum.*
6. *Scutum marked with lighter spots* .... *A. decorosum.*
Scutum of uniform color, reddish brown 7
7. *Tarsi II to IV, narrowed at extremity* .... *A. trachysauri.*
Tarsi II to IV, with tuberosity at extremity .... *A. concolor.*

B.—Female.

8. *Scutum marked with three metallic green spots* 9
Scutum reddish brown, of uniform color, without green spots 11
9. *Scutum at least as broad as long, punctations large, not close together* ... *A. Gervaisi.*
Scutum as long as broad, or longer, punctations fine, close 10
10. *Tarsi calcarate* .... *A. exornatum.*
Tarsi not calcarate .... *A. trimaculatum.*
11. *Body much broader than long* .... *A. transversale.*
Body longer than broad 12
12. *Scutum broader than long* 13
Scutum as long as broad, triangular 14
13. *Scutum with few fine punctations* .... *A. læve.*
Scutum with numerous deep punctations .... *A. trachysauri.*
14. *Tarsi three times as long as broad* .... *A. decorosum.*
Tarsi at least four times as long as broad .... *A. hydrosauri.*

GENUS AMBLYOMMA[1] Koch, 1844.

GENERIC DIAGNOSIS.—*Ixodinæ:* Eyes usually flat, slightly salient, sometimes hemispherical, brilliant, in a submarginal depression of the scutum. Capitulum long,

[1] SYNONYMY AND BIBLIOGRAPHY.

1844: *Amblyomma* KOCH, 1844, pp. 223-231.—IDEM, 1847, pp. 15-20.—FÜRSTENBERG, 1861, p. 208.—MURRAY, 1877, pp. 187, 188, 201-203.—BERTKAU, 1880, pp.

with valvate palpi. Anal groove semicircular, opening cephalad, uniting the sexual **grooves**; ordinarily no median ano-marginal groove. Scutum often marked with **color designs.** No anal plates in the male. Stigmata usually triangular, with rounded **angles.** Nearly always 11 posterior marginal festoons, especially in the male.

TYPE SPECIES.—*Amblyomma cajennense.*

Neumann has mentioned 86 species of *Amblyomma*, some of which are doubtful, and many of which are found on the American continent and adjacent islands. In his key to the genus he gives only three species, namely, *A. americanum*, *A. maculatum*, and *A. tuberculatum*, as occurring in the United States, and one species, *A. multipunctum*, for "North America." Of these, the Lone Star Tick (*A. americanum*) is quite common on cattle.

The following key to the species is translated from Neumann:

KEY TO THE SPECIES OF THE GENUS AMBLYOMMA.

[For forms reported in the United States, follow Roman type.]

Males 1
Females 47

A.—Male.

1. Postero-marginal festoons present 2
Postero-marginal festoons absent (Africa) .... *A. hippopotamense.*
2. Marginal groove present 3
Marginal groove absent 28
3. Marginal groove extending around the posterior border 4
Marginal groove not extending around the posterior border 24
4. Eyes flat 5
Eyes hemispherical, in sockets (Africa, Gaudeloupe, Guatemala) ... *A. variegatum.*
5. Scutum dark, with or without copper or yellowish white spots 6
Scutum light, with or without dark designs 20
6. Scutum without black spot occupying anterior third 7
Scutum black in anterior third (Port Natal) .... *A. annulipes.*
7. Coxæ I spinose 8
Coxæ I bilobed (Africa) .... *A. rugosum.*
8. Coxæ I bicuspid 9
Coxæ I armed with one long spine .... *A. maculatum.*
9. Coxæ I divided on posterior margin 10
Coxæ I divided nearly to anterior margin (Mexico, Paraguay) .... *A. ovale.*

109, 110.—CANESTRINI, 1890, pp. 483, 486, 488.—MARX, 1892, pp. 233, 235.—OSBORN, 1896, p. 261.—NEUMANN, 1897, p. 325.—IDEM, 1899, pp. 107, 108, 109, 200–283.—MORGAN, 1899, p. 138.—WARD, 1900a, pp. 204, 205.—IDEM, 1900b, p. 436.—SALMON & STILES, 1901, pp. 470–477. [See also RAILLIET, 1893, p. 710, as syn. of *Hyalomma.*]

1844: *Hæmalastor* KOCH, 1844, p. 223; type, *longirostris.*—IDEM, 1847, p. 15.—FÜRSTENBERG, 1861, p. 208.—MURRAY, 1877, pp. 187, 198.—MARX, 1892, pp. 233, 235.—TROUESSART, 1892, p. 47.—MORGAN, 1899, p. 138.—NEUMANN, 1899, pp. 166–180. [See also CANESTRINI, 1890, pp. 482, 483, 486.] [See also NEUMANN, 1901, MS., as syn. of *Amblyomma.*]

1863: *Ixodes* (*Amblyomma*) Koch in GERSTAECKER, 1863, p. 344.

1863: *Ixodes* (*Hæmalastor*) Koch in GERSTAECKER, 1863, p. 344.

1898: "*Amblyomnia*" of DALRYMPLE, MORGAN, and DODSON, 1898, p. 241 (misprint for *Amblyomma*).

10. Spine of coxæ IV as long as coxæ or nearly so 11

Spine of coxæ IV shorter than coxæ 12

11. *Punctations of scutum lacking from the triangular projections, flat, radiating in posterior half* (Mexico, Central and South America) .... ***A. cajennense.***

Punctations distributed over entire surface of scutum ...... ***A. americanum*****, p. 474.**

12. *Marginal swelling smooth or punctate* 13

Marginal swellings longitudinally striated (Australia) .... ***A. triguttatum.***

13. *Scutum with light, median, anterior spot* 14

Scutum without light median spot 15

14. *Anterior spot on scutum separated from postero-median spot by transverse band* (Africa) .... ***A. Hassalli.***

Anterior median spot connected with the postero-median spot (Africa) . ***A. splendidum.***

15. *Punctations of scutum very numerous on entire surface* 16

Punctations few, absent from some places 19

16. *Spines of coxæ I short* 17

Spines of coxæ I very long (Central and South America) .... ***A. fossum.***

17. *Spine of coxæ IV very short and feeble* 18

Spine of coxæ IV long and strong; body broad (Mexico) .... ***A. coelebs.***

18. *Punctations very fine, obsolete* (Brazil) .... ***A. concolor.***

Punctations large, unequal (South America) .... ***A. Geayi.***

19. *Punctations of scapular angles large, about 10 in number* (on *Spilotes variabilis*) (Mexico and Central America or South America?) .... ***A. sparsum.***

Punctations of scapular angle very fine, 20 at least (French Guiana) ....
A. paulopunctatum.

20. *Design on scutum forming an* H *and a* Y *consecutively* (Africa) .... ***A. eburneum.***

Design on scutum not forming an H *or a* Y 21

21. *A complete transverse band near middle of length* (Africa) .... ***A. subluteum.***

No such band present 22

22. *A linear postero-median spot present* 23

No such spot present (*?*) .... ***A. clypeolatum.***

23. *Linear postero-median spot separated from anterior spots* (Africa) ..... ***A. hebræum.***

Linear postero-median spot continuous with anterior spots (Africa) .. ***A. marmoreum.***

24. *Body broad, sides rounded* 25

Body straight, at least anterior portion, sides nearly straight 27

25. *Marginal groove continuous* (Australia) .... ***A. moreliæ.***

Marginal groove formed of punctations 26

26. *No* [*?*] *antero-lateral light spots* (Australia) .... ***A. limbatum.***

Antero-lateral light spots present (Africa) .... ***A. latum.***

27. *Coxæ I with two very long spines* (Brazil) .... ***A. striatum.***

Coxæ I with two short spines (Congo) .... ***A. cuneatum.***

28. Eyes flat 29

Eyes in orbit (Cape of Good Hope) .... ***A. sylvaticum.***

29. Punctations large and deep 30

Punctations small 43

30. Coxæ II and III spinose or tuberculose 31

Coxæ II and III unarmed (Africa) .... ***A. Foai.***

31. Body short, usually broader near the middle, sides rounded 32

Body long, broader in back, sides nearly straight 42

32. Punctations equal or subequal, large, abundant 33

Punctations unequal, some large, others very fine 40

33. Coxæ IV with one spine 34

Coxæ IV with two short spines (Uruguay) .... ***A. gypsatum.***

34. *Spine on coxæ IV short* 35

Spine on coxæ IV long 41

35. *Tarsi long, not suddenly narrowed* 36
Tarsi short, suddenly narrowed or tuberose 37
36. *Scutum raised in non-punctate elevations* (Mariana Islands, Philippines?) . *A. cyprium.*
Scutum level, median field with few punctations (Java) .... *A. quadrimaculatum.*
37. *Spines on coxæ I well developed* 38
Spines on coxæ I very short, in forms of tuberosities (Central and South America) .... *A. scutatum.*
38. *Second palpal article only one and one-half times as long as broad* (Central and South America) .... *A. nodosum.*
Second palpal article much longer than broad 39
39. *Punctations on entire surface of scutum* (South America) .... *A. Göldii.*
Punctations on scutum lacking in some places; body broad (Cochin China, Java, Borneo) .... *A. testudinarium.*
40. *Scutum yellow with brown spots; coxal spines conical* (Central and South America) .... *A. dissimile.*
Scutum brown with whitish scapular spots; coxal spines flat (Brazil) ... *A. humerale.*
41. *Hypostome with six rows of denticles* (South America) .... *A. calcaratum.*
Hypostome with eight rows of denticles (North America) ..... *A. multipunctum.*
42. *Hypostome with six rows of denticles* (South America) .... *A. varium.*
Hypostome with eight rows of denticles (Nicaragua) .... *A. crassipunctatum.*
43. Tarsi narrowed suddenly 44
Tarsi narrowed gradually 46
44. Coxæ I with subequal teeth; coxæ II and III spinose 45
Coxæ I with unequal teeth; coxæ II and III unarmed (Africa) .... *A. Thollon.*
45. Body short oval; scutum variegated .... *A. tuberculatum.*
Body subtriangular, scutum of uniform color (Brazil?) .... *A. fulvum.*
46. *Coxæ I unicuspid; scutum with white spots* (Cuba, Brazil) .... *A. albopictum.*
Coxæ I bicuspid; scutum with metallic spots (Philippines) .... *A. decoratum.*

B.—Female.

47. Eyes flat 48
Eyes in orbits 87
48. Coxæ I bicuspid 49
Coxæ I armed with one very long spine .... *A. maculatum.*
49. Scutum provided with punctations 50
Scutum smooth (Port Natal) .... *A. læve.*
50. Abdomen of uniform color 51
Abdomen with two red, symmetrical dorsal spots (Africa) .... *A. hippopotamense.*
51. Scutum brown or marked with lighter spots 52
Scutum yellow with dark spots 84
52. Scutum broader than long or as broad as long 53
Scutum oval or lozenge shape, longer than broad 86
53. Scutum triangular, postero-lateral borders nearly straight 54
Scutum cordiform, oval, or pentagonal, postero-lateral borders convex 69
54. Scutum medium size, 2 to 3.5 mm. long 55
Scutum very large, 5 mm. long (Cape of Good Hope) .... *A. crenatum.*
55. Scutum as broad or scarcely broader than long 56
Scutum much broader than long (Congo) .... *A. breviscutatum.*
56. *Eyes in front of anterior third of scutum* 57
Eyes at plane of or behind anterior third of scutum 63
57. *Eyes toward the anterior fourth of scutum* 58
Eyes in front of anterior fourth of scutum 61

58. *Scutum medium, a little broader than long, without spots, or with yellowish white spots* 59
Scutum large, as long (3.3 mm.) as broad, with red copper spots 60
59. *Scutum with yellowish white spots; punctations not confluent* (Mexico, Central and South America) .... *A. cajennense.*
Scutum without spots; punctations confluent in lines (Galapagos) .... *A. pilosum.*
60. *Eyes included in scutum* (Africa) .... *A. Hassalli.*
Eyes extending beyond scutum laterally (Singapore) .... *A. extraoculatum.*
61. *Median field of scutum with large posterior spot* 62
Median field of scutum without spot (Port Natal) .... *A. annulipes.*
62. *Scutum with spots lateral of cervical grooves* (Africa) .... *A. eburneum.*
Scutum without such lateral spots (Africa) .... *A. splendidum.*
63. *Coxæ I with two short teeth* 64
Coxæ I bidentate, one or both teeth very long 67
64. *Tarsi not suddenly narrowed; punctations deep* 65
Tarsi suddenly narrowed at the extremity 66
65. *Coxæ I with two sharp spines; coxæ II–IV each with one tuberosity* (Brazil) .....
A. parviscutatum.
Coxæ I with two blunt spines; coxæ II–IV each with two tuberosities (Guatemala).
A. sabaneræ.
66. *Punctations large, deep* (Cochin China, Java, Borneo) .... *A. testudinarium.*
Punctations small, superficial (Africa) .... *A. Tholloni.*
67. Coxæ I with one very long spine .... *A. americanum.*
Coxæ I with two long spines 68
68. *Eyes toward the middle of the length of the scutum* (Brazil) .... *A. striatum.*
Eyes toward the anterior third of the scutum (Bolivia) .... *A. vittatum.*
69. *Dorsal surface of capitulum with deep groove lateral of porose areas* (Australia) ..
A. triguttatum.
Dorsal surface of capitulum without such grooves 70
70. *Scutum broader than long* 71
Scutum as long as broad or scarcely broader than long 75
71. *Two spines on coxæ I long, close together, parallel* (Central and South America).
A. fossum.
Two spines on coxæ I short, separated, divergent 72
72. *Coxal spines conical, strong* (Banda Islands) .... *A. cordiferum.*
Coxal spines flat, rudimentary on coxæ II–IV 73
73. *Punctations coarse, at least in part* 74
Punctations very fine (Siam) .... *A. sublæve.*
74. *Hypostome with six rows of denticles; scutum 3.5 mm. broad* (Mariana Islands, Philippines) .... *A. cyprium.*
Hypostome with eight rows of denticles; scutum 1.7 mm. broad (Colombia) ......
A. deminutivum.
75. *Eyes toward the middle of the length of the scutum* 76
Eyes in front of the middle of the length of the scutum 78
76. *Punctations very fine; scutum pentagonal* (Brazil) .... *A. concolor.*
Punctations coarse, deep; scutum oval 77
77. *Scutum without large median spot; second palpal article twice as long as third* (Central and South America) .... *A. nodosum.*
Scutum with large median spot; second palpal article three times as long as third (South America) .... *A. calcaratum.*
78. *Punctations few* 79
Punctations numerous; spines on coxæ IV rudimentary 80
79. *Coarse punctations not scarce (about 30)* (Central and South America). *A. dissimile.*
Coarse punctations scarce (3 or 4) (Australia) .... *A. limbatum.*

PLATE XCVI.

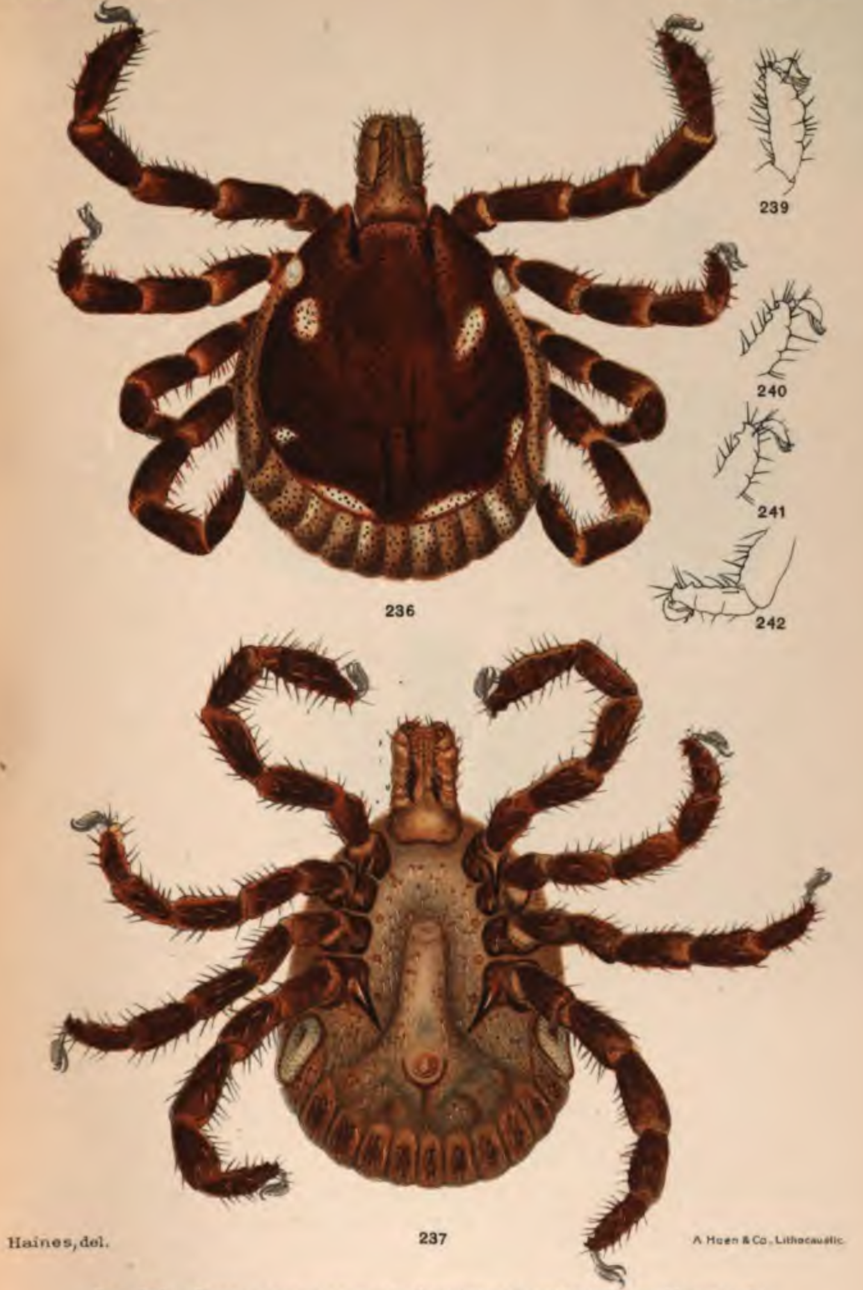

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FIG. 236. DORSAL VIEW OF MALE AMBLYOMMA AMERICANUM; MARYLAND. GREATLY ENLARGED. ORIGINAL FROM LIFE.

FIG. 237. VENTRAL VIEW OF SAME.

FIGS. 239, 240, 241, 242. TARSI I, II, III, IV OF FIG. 236.

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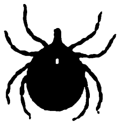

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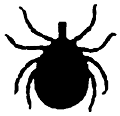

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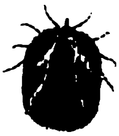

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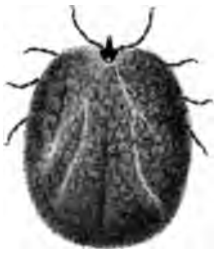

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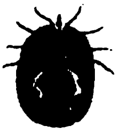

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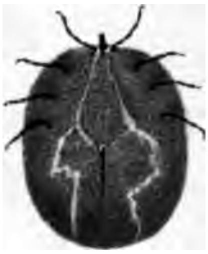

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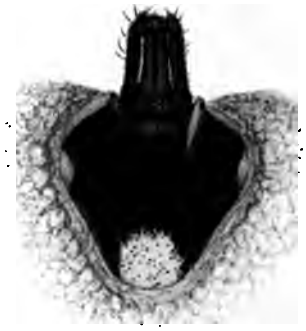

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FIG. 243. MALE AMBLYOMMA AMERICANUM. NATURAL SIZE. ORIGINAL.

FIG. 244. THE SAME. X2.

FIG. 245. VENTRAL VIEW OF SAME. NATURAL SIZE.

FIG. 246. THE SAME. X2.

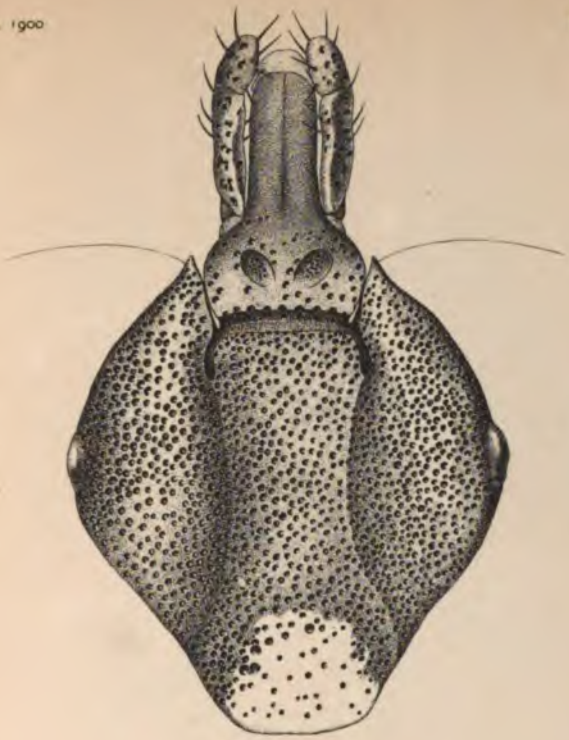
FIGS. 247, 248. DORSAL VIEW OF YOUNG AND OLD FEMALE AMBLYOMMA AMERICANUM. NATURAL SIZE. ORIGINAL FROM NATURE.

FIGS. 249, 250. THE SAME. X2.

FIGS. 251, 252. VENTRAL VIEW OF SAME. NATURAL SIZE.

FIGS. 253, 254. THE SAME. X2.

FIG. 255. SCUTUM AND CAPITULUM OF FEMALE AMBLYOMMA AMERICANUM. ENLARGED FROM LIFE. ORIGINAL.



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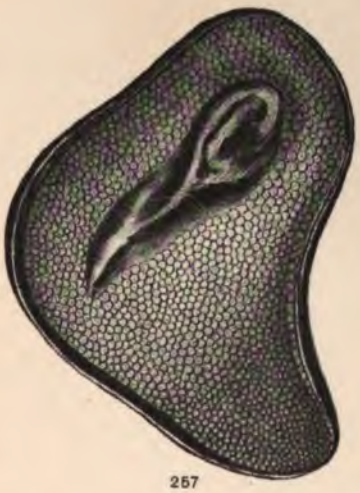

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FIG. 256. SCUTUM AND CAPITULUM OF FEMALE AMBLYOMMA AMERICANUM. GREATLY ENLARGED. ORIGINAL.

FIG. 257. LEFT STIGMEN OF FEMALE AMBLYOMMA AMERICANUM. GREATLY ENLARGED. ORIGINAL.

80. *Scutum pentagonal, punctations equal* (Spain) .... *A. dubitatum.*
Scutum cordiform, punctations larger in anterior angles 81
81. Scutum large (4 to 5 mm.); lateral copper-colored spots .... *A. tuberculatum.*
Scutum median (2.5 mm. or less).................................... 82
82. *Hypostome with six rows of denticles* 83
Hypostome with eight rows of denticles; a tubercle on coxæ III and IV (Viti-Levou Islands).. *A. acutangulatum.*
83. *Coxæ III and IV with one tubercle each* (Central and South America). *A. scutatum.*
Coxæ III and IV with two tubercles each(South America) .... *A. Göldii.*
84. *Scutum cordiform (5.5 mm. broad); tarsi gradually narrowed* (Zanzibar). *A. aureum.*
Scutum triangular, 2 to 4 mm. broad.................................... 85
85. *Eyes toward anterior third of scutum* (Cochin China, Java, Borneo)........... *A. testudinarium.*
Eyes toward anterior fourth of scutum (Africa)....................... *A. devium.*
86. *Scutum oval, punctations numerous on entire surface* (Trinidad) ..... *A. giganteum.*
Scutum lozenge shaped, punctations rare in the middle (*Nymph*) (Trinidad). *A. avicola.*
87. *Scutum triangular, deep brown* (Africa, Guadeloupe, Guatemala).. *A. variegatum.*
Scutum cordiform, yellowish white (Cape of Good Hope)........... *A. sylvaticum.*

The Lone Star Tick (*Amblyomma americanum*).[1]

(Figures 236-255.)

Specific diagnosis.—*Amblyomma: Male.*—Body oval, much enlarged caudad, brown red, lighter on the marginal ridge; 3 to 3.5 mm. long (capitulum included), 2.5 mm. broad. Scutum somewhat convex; cervical grooves not very deep, prolonged backward by a superficial depression; marginal grooves narrow, commencing a little in back of the eyes near the margin at its origin, very widely separated from the posterior margin where the ridge which it limits is three to four times as broad and divided into eleven festoons deeply separated and twice as long as broad; frequently two linear oblique spots, metallic silver, or gold, to green, postero-median of the eyes; two other small symmetrical spots, metallic silver, or gold, to green (after remaining in alcohol), tangential to postero-marginal shields in front of the marginal groove; other similar spots on the festoons. Eyes large, flat, yellowish to white. Punctations numerous, very fine. Ventral surface yellow ocher provided with fine, short, sparse hairs; dorso-submedian porose plates slightly posterior of coxæ IV; dark ramifications of the intestine sometimes visible. Genital pore at height of intercoxal space of coxæ II and III. Anus slightly in front of posterior quarter of the body. Stigmata large, whitish, elongate, comma-shaped, curved outward; stigmal pore anterior, small. Capitulum relatively long (0.9 to 0.96 mm.); base short, broad, postero-lateral angles rounded, not very prominent. Mandibles with digit 135 μ long; internal apophysis broad, transverse; external apophysis with two teeth, one terminal very small, the other very strong. Hypostome subspatulate with three rows of teeth on each half, the median rows contiguous. Palpi long, thin, the second article at least twice as long as the third. Legs medium; coxæ I bicuspid, lateral spine much longer; coxæ II and III provided with a very short and broad spine on their posterior border; coxæ IV with a strong and long spine. Tarsi I nearly four times as long as broad, rather brusquely narrowed near the tip; tarsi II to IV three times as long as broad with two consecutive spurs; pulvillum half as long as the hooks.

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[1] Synonymy and Bibliography.

1758: *Acarus americanus* Linnæus, 1758, p. 615; 1760, p. 615 [*Acarus ovalis planus, macula dorsali alba* Kalm, 1754, p. 20, from Pennsylvania and New Jersey].—Fabricius, 1794, p. 428.—Jördens, 1801, pp. 195–198, Tab. vii, figs. 10–13. [Not *Acarus americanus*, *A. nigua*, from Brazil, of Treviranus, 1831, pp. 185–191, Taf. xv, xvi.] [Renamed *Acarus nigua* by De Geer, 1778, p. 154.] [See also Latreille, 1804, p. 52, as syn. of *Ixodes nigua.*—Idem, 1829, p. 288.—Gervais & van Beneden, 1859, p. 461.—Siebold, 1850, p. 659 (pars).—Moquin-Tandon, 1861, p. 303.] [See also Fabricius, 1805, p. 356, as syn. of *Ixodes americanus.*] [See also Neumann, 1897, p. 365, as syn. of *Dermacentor americanus.*] [See also Dunglison, 1900, p. 7, as syn. of "*Pulex penetrans.*"]

1778: *Acarus nigua* De Geer, 1778, pp. 153–160, pl. xxxvii, figs. 7–13. *Acarus americanus* Linnæus, renamed. [Not "*Acarus nigua*" of Treviranus, 1831.] [See also Latreille, 1829, p. 288.] [See also Moquin-Tandon, 1861, p. 303, and Murray, 1877, p. 194, as syn. of *Ixodes americana.*] [See also Railliet, 1893, pp. 7–14; Neumann, 1897, p. 365, as syn. of *Dermacentor americanus.*]

1804: *Ixodes nigua* (De Geer) Latreille, 1804, pp. 52, 53.—Gervais & van Beneden, 1859, p. 461.—Moquin-Tandon, 1861, p. 303.—Blanchard, 1890, p. 328.

1804: *Rhynchoprion americanum* (Linnæus) Hermann (1804, p. —). [See Fabricius, 1805, p. 356, as syn. of *Ixodes americanus.*—Gervais, 1844, p. 247.]

1805: *Ixodes americanus* (Linnæus) Fabricius, 1805, pp. 355, 356.—Illiger, 1807, pp. 368–370.—Gervais, 1844, pp. 247, 248.—Küchenmeister, 1855, p. 422, in part.—Milner, 1858, p. 13.—Fitch, 1871, pp. 363–366.—Lintner, 1874, p. 631.—Conil, 1877, pp. 26, 27.—Braun, 1883, p. 212.—Neumann, 1888, p. 95.—Idem, 1892a, p. 100.—Idem, 1892b, p. 103.—The Lancet, 1892, I, p. 756.—Veterinary Journ., 1892, XXXIV, pp. 336–337.—Mosler & Peiper, 1894, p.

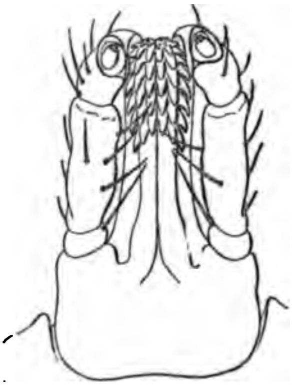
FIG. 238.—Ventral view of capitulum of *Amblyomma americanum*. Original.

Female.—Young: Body slightly more elongate oval than the male, 4.5 mm. long (including capitulum), 3 mm. broad. Scutum triangular in its posterior two-thirds, with posterior angle large and slightly curved, as broad as long (2 mm.); reddish brown with a white or metallic greenish yellow spot (after being in alcohol) in the posterior angle; cervical grooves deep in front, very broad and superficial in their

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321.—WOOD & FITZ, 1897, p. 346. [See also NEUMANN, 1897, p. 366, as syn. of *Dermacentor americanus.*]

1844: *Amblyomma americanum* (Linnæus) KOCH, 1844, p. 229.—IDEM, 1847, pp. 90, 91, pl. XVII, figs. 62, 63.—NEUMANN, 1899, pp. 201, 204, 209–211, 212.—WARD, 1900a, p. 204.—IDEM, 1900b, p. 436, fig. 258.—SALMON & STILES, pp. 474–477, figs. 236–255.

1844: *Amblyomma oblongoguttatum* KOCH, 1844, p. 228.—IDEM, 1847, p. 83, pl. XV, fig. 83; from Brazil. [See also NEUMANN, 1899, p. 209, as syn. of *Amblyomma americanum.*]

1867: *Ixodes unipunctata* PACKARD, 1867, pp. 66, 67 (Pennsylvania).—RILEY, 1887, p. 745. [See also NEUMANN, 1899, p. 200, and WARD, 1900b, p. 436, as syn. of *Amblyomma americanum.*]

1870: "*Ixodes unipictus* Packard" of VERRILL, 1870, p. 118 (lapsus for *I. unipunctata*).

1877: "*Ixodes americana* (Linnæus) Koch," of MURRAY, 1877, p. 194.

1880: "*Argas americanus* de Geer" of MÉGNIN, 1880, p. 134 (in part).

1886: *Amblyomma Foreli* STOLL (1886, p. 21, pl. XII, fig. 3; pl. XIV, fig. 3). [See also NEUMANN, 1899, pp. 209, 211, as syn. of *Amblyomma americanum.*]

1892: "*Amblyomma unipunctata*" (Packard) CURTICE, 1892b, pp. 226, 228–229, 234.—

posterior half; punctations numerous, small, equal, regularly distributed; eyes toward anterior third, similar to those of the male. Dorsal surface crossed by a marginal groove, equally distant from the border, limiting in back eleven festoons; punctations and wrinkles numerous, rendering the surface shagreened; hairs fine and not very numerous. Genital pore at height of coxæ II to III. Stigmata whitish, broad, triangular; stigmal surface finely punctate; stigmal pore small on elongate ridge. Capitulum 1.1 to 1.5 mm. long, differs from that of the male in the following details: Base longer; porose areas present, small, circular, oval, distant, divergent. Digit of mandibles 175 μ long. Palpi straight, second article relatively long. Legs thin, long, with long hairs; spine of coxæ IV scale-like, very short; tarsi long; tarsi I more than four times, tarsi IV four times as long as broad.

Fecundated and gravid female may attain 12 mm. in length by 8 mm. in breadth.

Nymph.—Body oval, swollen, 3 mm. long by 2.2 mm. broad, deep dirty gray. Shield relatively broader, reddish, without spot in alcohol specimen.

This tick has a wide distribution in North America and extends down into South America. It is more or less common on cattle and has also been found on man.

As stated on page 456 there has been considerable confusion as to the species which Linnæus originally named *Acarus americanus*. Linnæus's name is based upon a tick reported by Kalm (1754) from Pennsylvania and New Jersey, and described as "*Acarus ovalis planus, macula dorsali alba.*" This description clearly covers the most characteristic feature of the Lone Star tick; at the same time we are not inclined to deny that Kalm's description might also be interpreted as referring, in part at least, to *Dermacentor electus*. De Geer (1778) both described and figured what he supposed to be Linnæus's *Acarus americanus*, although he changed the name to *Acarus nigua*. De Geer's figures show beyond a question that the species he had before him was not a *Dermacentor*, but that it possessed the long palpi of the subfamily Ixodinæ, and also that it possessed the prominent spot on the posterior angle of the female scutum seen in *Amblyomma americanum*. There appears, therefore, little or no ground for doubt regarding the identity of De Geer's *Acarus nigua* with *Amblyomma americanum*. And even if we admit that Linnæus's description may be interpreted as covering both *Dermacentor electus* and *Amblyomma americanum*, it is necessary to accept De Geer (1778) as the first reviser who established the species to which *Acarus americanus* should be applied. On the rule of the first reviser, therefore, *Acarus americanus* Linnæus (1758) should be placed in the synonymy of *Amblyomma americanum* instead of in the synonymy of *Dermacentor electus*. The specific name *americanus* was subsequently transferred from *Acarus* to the genera *Rhynchoprion*, *Argas*, and *Dermacentor*, the various authors in question believing that they were dealing with Kalm's original form, and overlooking the important illustration published by De Geer. It is

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Idem, 1892c, p. 237.—Francis, 1894, p. 451.—Mayo, 1897, pp. 126, 127.—Niles, 1898, pp. 26, 27, 30, pl. I, figs. 1–4.—Idem, 1898, pp. 46–50.

1896: "*Amblyomma unipuncta*" (Packard) of Osborn, 1896, p. 261.—Mayo, 1897, pp. 126, 127.—Morgan, 1899, pp. 128, 129, 130–133, 134, 141, pls. III–IV.

1896: "*Ixodes amerikanus*" of Schneidemühl, 1896, p. 340.

1896: "*Amblyomma amerikanum*" of Schneidemühl, 1896, p. 340.

1899: *Amblyomma unipunctatum* (Packard) of Neumann, 1899, p. 211, as syn. of *Amblyomma americanum*.

1898: "*Amblyomnia unipuncta* Pack." of Dalrymple, Morgan & Dodson, 1898, p. 241 (misprint for *Amblyomma unipunctatum*).

1899: "*Amblyoma unipuncta* Pack." of Lewis, 1899, p. 3 (misprint for *Amblyomma unipunctatum*).

very evident, however, that the name *americanus* has been used to cover a number of perfectly distinct species. In establishing the synonymy it is impossible in all cases to recognize with certainty the species which a given author has had under consideration, and in this event one is compelled to base his action largely upon the technical name adopted by the author in question.

Genus Hyalomma[1] Koch, 1844.

Generic diagnosis.—Eyes present, occasionally hemispherical, brilliant, in a submarginal orbit of the scutum; or flat, scarcely salient. Capitulum long, palpi valvate. Anal groove semicircular, opening forward, uniting the sexual grooves, and followed by a median ano-marginal groove. Body elongate oval. Color more or less deep brown.

Male.—With two pairs of ventral shields: two adanal, triangular, large; two lateral of these, smaller, straight; further, frequently two accessory shields posterior of the adanal. Stigmata comma-shaped, tail long. Scutum festooned on posterior margin. Tarsi calcarate.

Female.—Stigmata triangular; posterior margin festooned before replete stage.

Type species.—*Hyalomma ægyptium* (Linnæus).

Neumann recognizes three species of this genus, none of which appear to have been collected in North America.

Key to the Species of the Genus Hyalomma.

1. *Eyes salient; coxæ I incised* 2
   Eyes flat; coxæ I not incised; scutum with numerous equal punctations; median border of adanal shield longer than posterior border; only the male known .... *H. crassitarsus.*
2. *Scutum with numerous unequal punctations; median border of adanal shield longer than posterior border* .... *H. ægyptium.*
   Scutum with few, equal punctations; median border of adanal shield shorter than posterior border .... *H. affine.*

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CONTAGIOUS DISEASES OF ANIMALS IN FOREIGN COUNTRIES.

By George Fayette Thompson,
Editorial Clerk, Bureau of Animal Industry.

GREAT BRITAIN.

RABIES.

Dr. Alex. C. Cope, chief veterinary officer for the board of agriculture for Great Britain, makes this gratifying statement in his report for 1899 with reference to rabies in Great Britain.

> It is with great satisfaction I am able to announce that there is now every reason to believe that it has been extinguished in Great Britain, the last case confirmed by the board's veterinary officers having occurred in Glamorganshire in November, 1899, while in those counties in which it has from time immemorial been most prevalent, namely, the Ridings of Yorkshire, Lancashire, and Staffordshire, no case has occurred since December, 1898.

Dr. Cope gives a tabular statement of the number of counties where rabies has occurred and the species of animals attacked, with the number of each, for the period of 1887 to 1899, inclusive. This table is reproduced below:

Rabies in Great Britain, 1887–1899.

Year.	Counties.	Animals attacked.					
		Dogs.	Cattle.	Sheep.	Swine.	Horses.	Deer.
1887	28	217	11	5	3	4	257
1888	19	160	2	7		5	2
1889	20	312	9	11	4	4	
1890	20	129	2		1	2	
1891	17	79		1		1	
1892	12	38	2				
1893	18	93				1	
1894	17	248	6		4		
1895	29	672	7	37	8	3	
1896	41	438	4	17		1	
1897	30	151	4	9	2	1	
1898	10	17					
1899	4	9					

A table is also given, compiled from official statistics, which shows the number of persons who have died of hydrophobia or rabies in England and Wales during the fifty-one years of 1848 to 1898, inclusive. The total number is 1,112. The table follows:

Number of persons who died of rabies in England and Wales, 1848–1898.

Year.	Persons.	Year.	Persons.	Year.	Persons.
1848	7	1865	19	1882	28
1849	17	1866	36	1883	34
1850	13	1867	10	1884	28
1851	25	1868	7	1885	60
1852	15	1869	18	1886	26
1853	11	1870	32	1887	29
1854	16	1871	56	1888	14
1855	14	1872	39	1889	30
1856	5	1873	28	1890	8
1857	3	1874	61	1891	7
1858	2	1875	47	1892	6
1859	4	1876	53	1893	4
1860	3	1877	79	1894	13
1861	4	1878	50	1895	20
1862	1	1879	35	1896	8
1863	4	1880	29	1897	6
1864	12	1881	34	1898	2

The board, believing that rabies is now completely stamped out in England, will now turn its efforts toward keeping the disease from entering from any source.

SWINE FEVER.

The conditions with reference to swine fever have improved but slightly. There were 2,322 cases determined in 1899, while in 1898 there were 2,514.

GLANDERS.

Glanders increased in 1899 over 1898. In 1899 the number of counties reported was 35 and the number of cases 1,472; in 1898 the number of counties was 30 and the cases 1,385.

ANTHRAX.

Anthrax has been prevalent, but has not increased over the previous year of 1898. However, the number of cases among swine has been larger than heretofore.

SHEEP SCAB.

This disease prevailed in the same number of counties as in 1898, but there was a marked falling off in the number of outbreaks.

SWITZERLAND.

Reports for Switzerland for the month of August have not been received, but it is believed that the data for that month would not change the general result very much. It is noted that foot-and-mouth disease has increased from 544 cases in 1899 to 11,469 in 1900, and that there has also been a larger increase in rouget. In 1899 the number of cases of rouget was 2,332, while in 1900 there were 5,884.

Cases of contagious diseases among domestic animals in Switzerland in 1900.

Name of disease.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Blackleg	12	8	12	16	14	75	....	193	131	53	31	6	551
Anthrax	13	11	11	9	12	8	....	25	14	12	13	8	136
Foot-and-mouth disease	2,781	2,435	1,262	893	1,103	1,703	....	384	116	210	395	187	11,469
Glanders	10	16	27	5	4	3	....	5	2	5	6	11	94
Rouget	324	368	437	303	259	480	....	1,621	737	510	606	239	5,884
Sheep scab	33	35	15	....	....	....	....	312	41	....	34	....	470
Tuberculosis	6	10	....	7	....	....	....	9	7	7	4	....	50
Rabies	....	....	....	....	....	3	....	1	....	....	....	....	4

FRANCE.

The number of outbreaks of contagious pleuro pneumonia in France in 1900 was 206, being exactly the same as in the previous year. The number of animals slaughtered on account of the disease was 94 fewer than in 1899, and the inoculations increased 212 in number. A comparison of the outbreaks reported for the last six years, which may be seen in a table below, shows that practically there has been no progress made during this time toward eradicating the disease.

Aphthous fever, or foot-and-mouth disease, increased to an alarming extent during 1900, the number of outbreaks being 77,604 as against 43,098 in 1899 and 91,458 in 1898. In 1895 the number of outbreaks was but 677. The term "outbreaks" means "farm premises." It does not, therefore, show the number of animals actually having foot-and-mouth disease, this sum being left unrecorded. By consulting the tabular report for the year it will be seen that the outbreaks gradually but rapidly increased from 889 in February to 8,509 in December. A few months showed a larger number of outbreaks than December. The number of outbreaks in 1895 was but 677, which, compared with the number (77,604) in 1900, shows an alarming condition of affairs.

The number of cases of rabies continues to be large. March had 304 cases—the largest number for any month—while the smallest number for any month was 181, in November. The comparative table below shows that since 1896 the number of cases has been on the increase, from 1,687 in 1896 to 2,771 in 1900.

Contagious diseases among domestic animals in France during the year 1900.

Name of disease.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Contagious pleuropneumonia:													
Number of outbreaks....	23	23	17	13	9	10	14	17	12	13	13	42	206
Number slaughtered	45	44	31	26	16	36	16	47	32	20	33	74	420
Number inoculated	198	121	109	92	71	154	79	63	123	80	192	113	1,395
Aphthous fever (outbreaks).	1,433	889	1,234	2,798	3,865	6,735	9,620	10,746	9,286	11,323	11,165	8,509	77,604
Sheep scab (outbreaks)......	14	18	27	9	16	10	8	3	4	6	4	14	133
Sheep pox (outbreaks)	40	75	19	12	9	6	20	18	38	131	269	193	830
Anthrax (outbreaks)	27	22	31	33	44	28	46	54	52	54	55	45	491
Blackleg (outbreaks)........	67	52	72	59	50	61	67	98	63	88	111	73	861
Glanders and farcy (outbreaks)	58	64	69	70	85	78	62	73	48	68	50	58	783
Rabies (cases)	208	230	304	256	267	231	245	226	216	212	181	195	2,771
Rouget (outbreaks)	22	17	9	15	12	17	69	20	24	33	44	40	322
Hog cholera (outbreaks)	27	16	12	5	45	24	12	21	9	12	46	16	245

Prevalence of certain contagious diseases of animals for the years 1895 to 1900.

Name of disease.	1895.	1896.	1897.	1898.	1899.	1900.
Contagious pleuropneumonia:						
Number of outbreaks..............................	224	189	181	110	206	206
Number slaughtered..............................	539	400	404	290	514	420
Number inoculated................................	1,980	1,413	1,101	786	1,183	1,395
Aphthous fever..	677	2,334	1,601	9,458	43,098	77,604
Rabies..	1,692	1,687	2,073	1,781	2,374	2,771

SWEDEN.

Outbreaks of contagious diseases of domestic animals in Sweden for the year 1900.

Name of disease.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Anthrax..	17	9	16	17	32	35	26	22	15	8	11	4	212
Emphysema infectiosum.......................	3	1	4	2	4	4	9	8	6	3	3	4	49
Swine diphtheria	....	1	2	....	....	....	....	....	....	....	....	....	3

DENMARK.

The condition of the domestic animals of Denmark, so far as contagious diseases are concerned, is a little better than last year, and is not bad. The accompanying table does not include the reports for November and December, as they have not come to hand.

In 1896 Denmark had 460 cases of foot-and-mouth disease; in 1897, but 5 cases; in 1898, none; in 1899, 1; and in 1900, 9. These 9 cases occurred in the first three months of the year.

Cases of contagious diseases among domestic animals in Denmark for the year 1900.

Name of disease.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Anthrax	8	10	14	8	8	5	6	7	7	10	.....	.....	83
Foot-and-mouth disease	3	5	1	.....	.....	.....	.....	.....	.....	.....	.....	.....	9
Cerebro-spinal meningitis	3	.....	8	5	3	1	3	2	1	4	.....	.....	30
Glanders	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Malignant catarrhal fever	7	7	7	6	5	8	21	7	9	10	.....	.....	87
Swine plague or hog cholera (chronic)	.....	.....	2	2	1	3	.....	2	.....	3	.....	.....	13
Rouget;													
Acuté	77	61	62	56	54	44	72	67	65	78	.....	.....	636
Chronic	13	6	7	6	2	3	8	15	23	15	.....	.....	98
Nodular erythema	50	28	36	44	35	81	190	300	256	398	.....	.....	1,418

BELGIUM.

The contagious diseases of animals reported for Belgium show a much better condition than in 1898. Anthrax appears to be the only disease that shows an increase in the number of cases. The number of cases of foot-and-mouth disease was but 1,418, while in 1899 it was 16,127. There were 81 cases of rabies in 1900, while the year previous there were 444 cases. Glanders and farcy were reduced from 406 cases in 1899 to 114 in 1900.

Cases of contagious diseases of domestic animals in Belgium for the year 1900.

Name of disease.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Glanders and farcy	9	20	13	9	35	5	4	1	2	8	5	3	114
Foot-and-mouth disease	181	93	68	89	115	122	36	16	123	107	159	309	1,418
Rabies	11	7	13	10	8	9	9	1	3	4	3	3	81
Anthrax	44	20	31	30	33	34	40	11	39	36	32	32	382
Foot rot	.....	.....	30	.....	.....	.....	.....	.....	.....	2	4	6	42
Sheep scab	51	.....	50	.....	.....	.....	2	.....	.....	.....	.....	.....	103

NETHERLANDS.

Although there are four months in 1900 for which no report is available, there are data sufficient to show that foot-and-mouth disease is on the decrease. The eight months for which reports are at hand show that there were 40,246 cases, while the twelve months of 1899 showed 119,922 cases. In 1897 there were 603,623 cases.

Cases of contagious diseases of animals in Netherlands for the year 1900.

Name of disease.	January.	February.	March.	April.	May.	June.	November.	December.	Total.
Foot-and-mouth disease....	1,767	725	612	641	1,146	2,635	24,094	8,626	40,246
Farcy, or mange............	5	2	4	7	11	7	4	3	43
Sheep scab	317	585	378	249	141	14	113	177	1,974
Rouget	9	8	8	9	26	34	12	27	134
Anthrax.......................	18	13	22	20	23	13	18	15	142
Foot rot of sheep...........	36	16	11	42	104	21	26	72	328

GERMAN EMPIRE.

The noticeable feature of the German statistics is the decrease of foot-and-mouth disease. In 1900 there were 25,359 localities infected, as against 82,305 in 1899. The number of farm premises where the disease was reported was 71,168, whereas in 1899 there were 393,457 such places. The table shows that January, 1900, had 23,003 farm premises, while December had but 1,849.

Number of localities and farms infected with contagious diseases of animals in the German Empire for the year 1900.

Name of disease.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Glanders:													
Localities......	72	77	69	71	56	59	59	57	77	100	114	108	919
Farms	94	99	85	85	64	74	72	74	103	121	148	139	1,158
Pleuropneumonia:													
Localities......	5	13	11	21	20	21	15	15	13	13	18	18	183
Farms	13	17	18	24	20	21	15	18	16	14	20	20	216
Foot-and-mouth disease:													
Localities......	6,883	4,443	2,833	2,200	1,419	1,050	872	874	907	1,489	1,471	918	25,359
Farms	23,003	11,495	5,857	4,370	3,639	2,873	2,949	3,042	3,176	4,936	3,979	1,849	71,168
Hog cholera, including swine plague:													
Localities......	209	205	257	388	375	459	435	431	402	420	412	435	4,428
Farms	261	288	324	478	458	648	613	618	519	547	532	579	5,865

NORWAY.

The report for Norway, which lacks the report for May to make it complete, is practically the same as for the previous year.

Cases of contagious diseases of domestic animals reported in Norway for the year 1900.

Name of disease.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Anthrax	28	38	21	47	....	52	36	29	20	31	25	28	355
Blackleg	2	3	2	....	....	....	1	2	1	2	1	......	14
Braxy	10	1	3	1	....	....	......	......	......	9	8	14	46
Malignant catarrhal fever of cattle	24	34	23	30	....	28	36	20	16	13	26	12	262
Rouget	41	25	30	31	....	38	101	166	161	153	119	61	926
Hog cholera	....	14	....	....	....	....	......	204	19	6	23	......	266

HUNGARY.

The following statistics of contagious diseases of domestic animals are taken from the Jahresbericht über das Veterinärwissen in Ungarn, 1899. The report for 1900 is not yet available.

ANTHRAX.

Anthrax was officially reported from 57 counties and from 1,499 farm premises. The number of horses affected was 245; cattle, 2,053; sheep, 614. Deaths from the disease were as follows: Horses, 237; cattle, 2,011; sheep, 614. The loss was greater than in 1898 by 21 horses and 146 cattle, but was diminished in the number of sheep lost, being 496 fewer than in 1898. A comparison of data for four years follows:

Kind of animal.	1896.		1897.		1898.		1899.	
	Affected.	Died.	Affected.	Died.	Affected.	Died.	Affected.	Died.
Horses	191	190	209	197	216	216	245	237
Cattle	1,780	1,703	1,889	1,739	1,888	1,865	2,053	2,011
Sheep	1,074	800	968	968	1,100	1,110	614	614
Total	3,045	2,693	3,066	2,904	3,204	3,191	2,912	2,862

RABIES.

There were 1,272 cases of rabies reported for 1899, as follows: Dogs, 1,125; cats, 12; horses, 12; cattle, 68; sheep, 5; hogs, 50; donkey, 1. Of the number, 86 dogs and cats died of the disease, 879 were killed, and 171 escaped. The number of dogs which had been bitten and killed as "suspected" in 1899 was 3,994. There were 644 other animals which were killed after being bitten before the disease developed. The table shows the prevalence of rabies for five years:

Kind of animal.	1895.	1896.	1897.	1898.	1899.
Dogs	1,227	1,274	1,282	1,219	1,125
Cats	....	....	....	4	11
Horses	13	14	22	11	12
Cattle	60	74	120	35	68
Sheep	1	8	40	7	5
Hogs	....	63	53	51	50
Donkey	....	....	....	....	1

GLANDERS.

A marked decrease in the number of cases of glanders is reported for 1899 over the previous year, being 918 as against 1,745. The farm premises reported were 463. Eight hundred and fifty-one horses were killed and 10 died of the disease. In addition, 57 suspected horses were killed, thus increasing the total to 918, which is a decrease of 827 from 1898. The number of horses affected was four-hundredths of 1 per cent of the whole number in Hungary. The number of horses that have been affected for the last five years is shown herewith:

1895	1,241
1896	681
1897	931
1898	1,745
1899	918

FOOT-AND-MOUTH DISEASE.

This disease has been on the wane since 1896. The number of cases reported in 1895 was 21,830, occurring on 2,501 farm premises; in 1898 the number of cases was 33,649; thus 1899 shows a less number by 11,819. Of the total number of animals affected, 19,947 were cattle, 1,538 sheep, and 345 hogs. The deaths from the disease reached three-tenths of 1 per cent of the number of animals attacked. Data for five years are given in the table:

	1895.	1896.	1897.	1898.	1899.
Cattle affected	282,282	572,809	70,491	28,832	19,947
Sheep affected	25,620	178,612	25,450	3,806	1,538
Hogs affected	59,940	82,931	3,758	1,011	345
Total	367,842	834,352	99,699	33,649	21,830

PLEUROPNEUMONIA.

This disease was greatly diminished during the year 1899. It was identified on 5 farm premises, and the number of cases was 10. In

1898 the farm premises numbered 26 and the cases 63. All affected animals were officially slaughtered. Besides the 10 affected cattle, 95 others were killed as "suspicious," and 577 were sent to the slaughterhouse because of having been exposed. Besides these, 301 cattle were slaughtered in 11 other counties as suspicious. The total, therefore, was 983 head. The table gives data for four years for comparison:

Disposition of cattle.	1896.	1897.	1898.	1899.
Died and slaughtered as affected	313	262	390	10
Slaughtered as suspicious	781	735	254	396
Exposed (sent to slaughterhouse)	7,563	4,580	2,289	577
Total	8,657	5,577	2,933	983

SHEEP POX.

In 1899 the number of sheep affected with sheep pox was 5,129, being reported from 229 farm premises. This is a decrease of 272 cases and 10 farm premises from the report for 1898. Of the 5,129 sheep affected, 486 died and 2 were killed. The death rate among the affected animals was 9.5 per cent, as against 10.5 per cent for the previous year.

	1895.	1896.	1897.	1898.	1899.
Sheep affected	2,274	938	9,536	5,401	5,129
Sheep died	265	254	1,526	569	486
Farm premises reported			292	239	229

FOOTHALT.

This disease, which appeared in 71 cases in 1898, did not show itself in 1899.

BLISTER UPON THE GENITALS.

This disease shows an increase of 35.1 per cent over the year 1898. It appeared on 544 farm premises, in 21 counties, and 264 horses and 587 cattle were affected. This was an increase of 111 farms and 2 counties and of 127 horses and 95 cattle over 1898. The table shows the statistics for five years:

	1895.	1896.	1897.	1898.	1899.
Horses affected	79	118	81	137	264
Cattle affected	338	217	134	492	587
Counties reported		15	16	19	21
Farm premises reported		238	143	433	544

SCAB.

Scab existed upon 1,226 farm premises in 44 counties. There was a decrease among sheep of 71.3 per cent. The number of sheep affected was 1,856, as against 6,483 in 1898, but there were 1,794 horses affected, as against 949 in 1898. The total number of cases reported for 1899 was 3,650, or 3,782 fewer than in the previous year. A table for comparison of figures for five years follows:

	1895.	1896.	1897.	1898.	1899.
Horses affected	2,500	1,713	970	949	1,794
Cattle affected	32	119	4	....	....
Sheep affected	4,003	4,156	3,222	6,483	1,856

RED MURRAIN OF SWINE.

This disease was reported from 4,648 farm premises in 57 counties, being a large increase over 1898. The number of hogs attacked was 19,213, of which 10,224 died. The table below affords comparisons for four years:

	1896.	1897.	1898.	1899.
Hogs affected	28,806	11,068	7,624	19,213
Counties reported	52	49	46	57
Farm premises reported	....	2,764	1,748	4,648

HOG CHOLERA.

Hog cholera was discovered on 40,967 farm premises in 62 counties. The number of hogs attacked by the disease was 327,716, of which 199,151 died, 4,618 were killed at once, and 1,790 were slaughtered as being suspected. The total loss was 3.5 per cent less than in 1898. A comparison of data for four years follows:

	1896.	1897.	1898.	1899.
Hogs attacked	868,777	514,291	318,030	327,716
Hogs died of the disease	639,765	360,838	206,445	119,151
Hogs killed	13,093	5,201	2,827	4,618
Farm premises reported	....	84,828	40,951	40,967
Counties reported	56	60	59	62

BUFFALO CHOLERA.

The number of cases of buffalo cholera reported in 1899 was 299, being less than for the year before, equaling 4 per cent. It appeared on 101 farm premises, and 262 animals died from it. Data for comparison for five years follows:

	1895.	1896.	1897.	1898.	1899.
Cases reported	206	350	99	313	299
Farm premises reported	....	153	69	105	101

ITALY.

The statistics for Italy are from official sources, but lack reports of four weeks to make them complete. A comparison with the previous year shows that all diseases reported were on the increase except sheep scab, sheep pox, and barbone of buffalo. In 1899 there were reported 12,997 cases of foot-and-mouth disease, while in 1900 the number reached 19,199, an increase of 6,202. Hog cholera and anthrax also increased very much, while no case of pleuropneumonia was discovered.

Cases of contagious diseases of domestic animals in Italy during the year 1900.

Name of disease.	January.	February.	March.	April.	May.	June.
Foot-and-mouth disease	2,800	2,382	1,140	3,566	2,294	2,579
Hog cholera and swine plague	50	74	64	656	830	806
Anthrax	496	34	15	259	62	218
Blackleg	40	18	5	26	21	39
Glanders and farcy	15	5	5	118	22	40
Rabies	3	1	....	29	23	52
Tuberculosis	3	3	....	21	19	16
Sheep scab	106	1,162	....	9,164	1,220	1,689
Sheep pox	....	....	....	....	10	....
Barbone of buffalo	....	....	17	....	22	27
Agalassia contagiosa	60	....	....	2,978	785	3,823

Name of disease.	July.	August.	September.	October.	November.	December.	Total.
Foot-and-mouth disease	2,019	909	622	283	358	247	19,199
Hog cholera and swine plague	991	718	646	788	562	347	6,532
Anthrax	544	645	139	172	281	117	2,982
Blackleg	15	20	25	34	106	26	375
Glanders and farcy	44	33	17	33	33	29	394
Rabies	16	18	9	18	13	24	206
Tuberculosis	9	7	16	13	13	8	128
Sheep scab	2,066	1,391	180	1,318	1,594	3,447	23,337
Sheep pox	41	....	1	....	....	7	59
Barbone of buffalo	5	3	3	....	....	....	77
Agalassia contagiosa	2,871	703	1,389	98	2,370	30	15,107

MISCELLANEOUS INFORMATION.

Mexican cattle industry.—Consul Griffith, of Matamoras, under date of March 23, 1900, says:

Mexico contains a great many haciendas admirably adapted and almost exclusively devoted to the raising of cattle. A fact which is attracting general interest here is that every season shows an improvement in the care taken of the animals and also in the class imported. The stockmen throughout this country are taking such an interest in this direction and have imported so many purebred cattle from the United States that on many haciendas one may find animals which compare favorably with those on noted breeding farms in the North. In former years they consisted exclusively of the old long-horned Spanish and Mexican types, which have large bones and frames and long legs, but are deficient in flesh. This deficiency is certainly not due to the country, for the climate, grass, water, and general topography are decidedly favorable to animal growth and comfort, and, while it is a generally recognized fact that Mexican stock is inferior to United States animals, it is the prevailing opinion that a cross between the pure blood of the North and the cow acclimated here produces a large, healthy, vigorous offspring, with an unusually compact, muscular development.—(*Consular Report, June, 1900.*)

American horses in Switzerland.—Consul Gifford writes from Basel April 10, 1900:

For several years past American driving and saddle horses have been imported in large numbers into Switzerland. This spring the business seems to be assuming unusual activity, and one shipment of 72 American animals has already arrived in Basel. These are offered to the public exclusively as draft and cart horses. The Swiss importer obtains for them about 1,400 francs ($270) each, and up to this time they appear to have given satisfaction. They are bought up all the more eagerly since it is thought that further opportunities for such purchases may not be frequent in the near future. It is reported here that the demand for American horses for South Africa has occasioned a scarcity which may render exportation to Europe impracticable for the present.—(*Consular Report, July, 1900.*)

Horse breeding in Belgium.—The breeding of fine draft horses is made a specialty in Belgium, and is carried on extensively with great success and profit. Colts from 5 to 6 months old sell for from $60 to $100, and at 18 months from $140 to $180, while geldings from 4 to 6 years old bring from $200 to $350.

Liege is the principal horse market of the country, and every M day the city is full of fine horses, and buyers are present from most the countries of Europe. The farmers take great pride in their sto The breeds most in favor are the Flemish and Norman; both are about equal value.

The following clipping from Le Patriote, of Brussels, gives an exc lent account of the condition of the industry in Belgium and what Government and provinces are doing for it:

The reports of the provincial commissions for agriculture are unanimous in stat that breeding of the big Belgian draft horse continues to be a very lucrative spec tion. The prices of good horses are always high.

The commercial movement with foreign countries in 1898 was as follows:

Country.	Imports.	Expo
	Head.	*Hea*
Germany:		
Horses	1,176	15
Colts		1
England	21,643	
France:		
Horses	7,717	3
Colts	505	
Grand Duchy of Luxemburg:		
Horses	1,149	6
Colts		
Holland:		
Horses	2,246	1
Colts	1,274	
Russia	886	
Switzerland	....	1
United States	6,080	......
All other countries:		
Horses	158	
Colts		
Total	42,834	2

As may be seen, the importations exceed the exportations by 12,857 head. excess has been continuous since 1893, but it must be attributed chiefly to the im tation into Belgium of slaughter horses from England.

The provincial regulations relative to the betterment of the different breed horses continue to give good results. During the year 1898 the carrying out of t regulations caused a total expenditure of 272,691.41 francs ($52,629.44), of which Government paid 163,181.90 francs ($31,494.11) and the provinces 109,509.51 fr ($21,135.33).

Besides this, the Government granted to the national society for the breedin the Belgian draft horse a subsidy of 20,000 francs ($3,860) and to the society for encouragement of the breeding of half-breeds a sum of 10,000 francs ($1,930). sum of 24,000 francs ($4,632) was inserted in the budget to be distributed in nati premiums to owners of choice stallions of native breeds. The Government has sequently assumed, in 1898, the payment of a total sum of more than 217,000 fr ($41,881) as encouragement for the breeding of horses.

The following table gives the number of horses imported from respective countries for the years given, and the figures for the Uni

States are good; but a large number of these animals were for the slaughterhouse:

Country.	1898.	1897.	1896.
England	21,643	22,454	16,577
United States	6,080	4,183	2,598
France	7,717	7,954	6,525

Great care is taken to keep up the high standing of the breeds, for all stallions must be licensed by the Government.

But little attention is paid to the breeding of roadsters or saddle horses. These are principally imported from England and are quite expensive. I think there might be a good opening here for these classes from the United States. However, great care should be taken to send only the best horses, for the standing of American animals has been injured by the shipment to this country of inferior specimens.—(*Alfred A. Winslow, consul at Liege, in Consular Report for April, 1900.*)

American horse meat in Denmark.—Vice-Consul Blom writes from Copenhagen January 16, 1900:

Several years ago I called the attention of the Danish dealers in horse meat to the American supply. I have now to report that the business is increasing rapidly, and the meat from the United States gives satisfaction. The consumption of horse meat in Denmark is comparatively large. Copenhagen is a distributing port for Sweden, Norway, Finland, Russia, and the German Baltic.—(*Consular Report, April, 1900.*)

Sheep and wool statistics of Russia.—Russia, according to Wool Markets and Sheep, has 60,000,000 sheep, of which one-fourth are Merinos, averaging 6 pounds of wool each; and the 450 woolen mills of European Russia employ 50,000 workmen and produce goods valued at 45,000,000 rubles.

How sheep scab was stamped out in New Zealand.[1]—In round numbers there are some 20,000,000 sheep in New Zealand, and, so far as is known, not a scabby sheep could be found among them, which is something to brag about as well as to be thankful for. Twenty years ago scab was rampant in this colony. At the end of 1881 out of the 14,000,000 sheep at that time in the two islands there were about 700,000 infested with scab, and numerous as were the infected animals the number was 200,000 less than in the previous year. Through the effects of stringent legislation, the strenuous efforts of inspectors, and the aid generally given by owners of flocks, the number of infected

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[1] This article was recently published by a correspondent in the Auckland Weekly News.

sheep gradually and rapidly diminished until, in the year 1893,
following clause was published in one of the inspector's reports:

> During the spring an examination of the flocks last infected with scab was n
> and no traces of it remained.

So that the following year the joyful intelligence was gazetted,
news spreading throughout the length and breadth of the col
"New Zealand is free from scab!" The disease was thus in abo
decade effectually eradicated, and neither by spontaneous genera
nor in any other way has it since put in an appearance.

There are 18,722 flocks of sheep in New Zealand, the size of
flocks being as follows:

Size of flocks.	Number.	Size of flocks.	Nu
20,000 and upward	144	1,000 and under 2,500	
10,000 and under 20,000	231	500 and under 1,000	
5,000 and under 10,000	341	Under 500	
2,500 and under 5,000	614		

Although a large percentage of these sheep are scattered througl
extensive plains or in valleys or running on high mountain range
is very creditable to the owners that there are no traces of scab t
found in any of the flocks, whether large or small, a state of th
that should prove an object lesson to any country where the dis
may unfortunately exist.

I come now to the interesting inquiry, "What measures v
adopted in New Zealand for the stamping out of the disease?" Bri
this inquiry may be answered as follows: (1) Our legislators, man
whom are sheep farmers, passed workable, up-to-date laws and r
lations in regard to sheep and scab; (2) these laws and regulat
were faithfully and energetically carried out by sheep inspectors
owners of flocks; and (3) an effective dip (lime and sulphur) was u
The clauses of the act are, of course, very stringent, as they req
to be, or the disease would never have been mastered and wiped

Poultry raising in Belgium.—It has been suggested that a re
on the method of raising fowls for the market in this country w
be of service, not only to those directly interested in the like busi
in our country, but a boon to the public at large. The succulenc
the "poulet de Bruxelles" has a very widespread reputation, not
among gourmets, but among all who have had the good fortune to t
upon the Continent and meet the same on the table.

The difference in quality between the fowl above mentioned and
of the same age and size of the ordinary variety is shown by the
that the first is sold in nearly all the markets in this country at do
the price. For example, a young poulet de Bruxelles, which we sh
consider about the size sufficient for a meal of two persons, is

to-day for 5 francs (96.5 cents), whereas one of the ordinary variety can be purchased for between 2 and 3 francs (38.6 and 57.9 cents).

The excellence of the fowl seems to depend, so far as can be ascertained, on the careful manner in which the sitting hen is treated, the cleanliness observed about her, as well as the careful feeding of the young chicken until sufficiently developed for eating purposes. Whether or not the methods pursued here differ from those followed by careful breeders in our country it is impossible for me to say. Travelers almost invariably express their astonishment at its tenderness and juiciness.

The choice of eggs for sitting purposes is considered a matter of great importance, and the freshest obtainable are almost invariably used. The best breeders seldom take eggs older than eight days for raising the best quality. Care is taken that the eggs given to one hen should be of the same age. The eggs when collected are kept at a very even and medium temperature until given to the hen, and are turned daily. This measure is taken, I am informed, to prevent the yolk, which is lighter than the white of the egg, from adhering to the top of the shell. The eggs chosen for the purpose above mentioned are also of an average size, those above medium being rejected, as they often contain double yolks. Eggs received from a distance, and consequently exposed to more or less shaking, are allowed to stand a day or two before being put under the hen. Great care is also taken that the eggs should be perfectly clean.

The nest is prepared of straw or cut hay, perfectly clean, dry, and odorless. As a rule, the sitting hens are located in corners where the greatest quiet is obtainable and are not exposed to great light. When so located they are not disturbed for any other purpose than the placing before them of their daily supply of food and water. As the hen leaves her nest at least once a day to search for food, to take exercise, etc., care is taken to put her food and water within reach of the nest, in order that the time that she is off the eggs may be materially shortened.

RAISING AND FEEDING.

When the young bird is hatched, it retains in its body part of the yolk of the egg from which it was produced, which suffices to nourish it for the first twenty-four hours, during which period only warmth is required, which is furnished either by the mother hen or must be afforded by a warm cloth, in case of the necessity of awaiting the hatching of the rest of the brood.

The food first given can be varied, but must be made up of ingredients containing large quantities of nitrogen, as this is required for the formation of the tissues. It is necessary, in fact, that the food should be composed of matter resembling in character an egg, together with milk. It is customary to mix with the food eggs, milk, and the blood of earthworms, field worms, and that of a commoner variety of fish; also to introduce, for the formation of bone, certain quantities of phosphate of lime found in grain and flour. In the early days flour should be given on account of the facilities of its digestion, grain being substituted therefor as the birds begin to gather strength. Wheat flour is generally used. The grain given is wheat, rice, millet, buckwheat, and corn, raw or cooked. Cooked potatoes are also often given as a change of diet. It is customary to vary the grain diet as much as possible, and to frequently administer it mixed. The food ordinarily employed is made up as follows: Hard-boiled eggs and wheat flour are mixed in milk, a little water being added. To this paste is added a small onion finely cut up, together with lettuce when green food is scarce. The mixture is ordinarily quite stiff, as too moist food is considered harmful for the young brood.

After the first few days a small quantity of whole grain is mixed into the paste, but if rapid development is desired the simple paste should be continued alone.

Great care is taken to keep the young brood in a dry, warm locality, which precaution, together with the proper food, prevents inflammation of the intestines and like troubles. As a rule, the birds are confined on wet days and allowed to run about as much as possible only in fine, sunny weather. In winter a more generous diet is given to enable them to withstand the cold. The daily ration of grain for the fowls is from 2½ to 3 ounces.—(*Geo. F. Lincoln, consul-general at Antwerp, in Consular Report, October, 1900.*)

Eggs, poultry, and meat in Great Britain.—M. de Loverdo has read before the Société Nationale d'Agriculture de France an article on the importation of eggs into Great Britain, of which the London Times gives, in an issue of recent date, a translation a full column in length, and in turn I use this material, condensing and adopting freely.

The importation of eggs into Great Britain last year was valued at $24,548,227, while the poultry and game figures were $3,821,633, an outlay of $28,369,860 in addition to that for the poultry and eggs produced in Great Britain.

M. de Loverdo describes the special cars in use, which are so made that chickens for this market can be fattened during the transport, one attendant being able to take care of a number of cars. Young Russian chickens bought at low prices are thus prepared for the English market and reach here alive, and the same system has been followed with success in Italy. Belgium has been fortunate enough in establishing a specialty, not only for the London market, but also in Paris, with its "petit poussin," for which restaurant keepers in both places willingly pay 48 cents apiece. They are ready for the table in six weeks, the particular breed of Flemish fowls which furnishes these early maturing chickens being known as the Braekel, which has long been famous for its precocity. French poultry breeders are urged to exhibit the attractive Mans and La Bresse chickens at the Smithfield dead-chicken show, held annually in London.

England is credited with but a small production of turkeys, and, in spite of the supplies from the county of Norfolk and, more recently, from Ireland, importations from abroad have increased enormously in late years, as the liking for turkeys is greatly on the increase in England. The British market is supplied primarily from Italy and France, Canada and parts of eastern Europe ranking next. M. de Loverdo does not mention the United States as sending poultry to this market. France sends two kinds of turkeys—from Solonge and Normandy, respectively. These used to find a ready market, but latterly have found formidable rivals in the Irish turkeys, which are better fattened and cared for. The Normandy turkey is more precocious than the Solonge and fattens very readily. The flesh is juicy and of an exquisite flavor, and commands about 4 cents a pound more. It is suggested that the Normandy turkey might with advantage be introduced into French midlands. Next to the Norfolk turkey, which occupies the place of honor in the English market, those from France and Ireland are most valued. But more turkeys are received from Italy than from France. The Italian turkeys possess a flavor almost equal to the Normandy birds, though their weight does not often exceed a dozen pounds. France exports annually 60,000 turkeys, while Italy exports from 600,000 to 800,000; but the birds from beyond the Alps find their way not only to London, but to Leipzig, Dresden, Frankfort, Berlin, and Hamburg, and they realize higher prices in those German towns than in England. During the last two or three years Canada has made extraordinary efforts to establish a turkey trade in England, the greatest care being bestowed upon the transport in cold storage; but, while these Canadian birds have no lack of quality and easily attain the weight of 20 pounds, it is said the refrigeration they are subjected to does not improve the flavor of the flesh. But this complaint about refrigeration is always made in Great Britain, and I judge from the statements of those who have made a fair, honest, and unprejudiced trial with refrigerated meat that chilled meat, as opposed to frozen meat, is all right if properly taken care of—if allowed to "thaw" out slowly and not put in the oven while cold. The general objection to it here seems to be based largely on prejudice, and I believe the consumer is not aware of the difference, provided the meat is not delivered cold. An acquaintance tells me that when in Australia he sent two lambs to friends here whom he knew would follow his instructions. He tried to have them arrive so that his friends could enjoy the novelty of "spring" lamb on Christmas Day. They were instructed to allow the carcasses to hang so that they would warm slowly and be at a natural temperature when put in the oven. His friends obeyed with exactness and reported that they never enjoyed better lamb; so that even frozen meat can be used and enjoyed if properly heated, as, of course, all Australian meat must be frozen in transport on account of the great distance. America, on the other hand, has an advantage in shorter distance; it can transport meat chilled and not frozen. The butchers here claim that in meat which has been frozen the blood vessels are found to have burst when the meat is cooked. The fact is the best American meat brought to this market is sold by the butchers—so great is the prejudice against "frozen" meat—as English meat, but it can generally be told by the smaller bones, as we kill younger cattle, while the poorer grades of English meat are often sold as American meat. And of course there are some very poor grades of English meat, for there is so much pedigree cattle of value too great to be killed until beyond the breeding age. It happens to be a fact at present that it is more difficult than formerly to get good meat in England, and if the statements of the butchers of Birmingham in their recent proclamation announcing a 4 cents per pound increase are to be believed, this is due to the lessening of the American supply, owing to the number of transports employed for South Africa and the amount of meat which must be shipped thither. Of course, the butchers do not confess that the decrease in the American meat supply means a decrease in the supply of good meat, though this is the fact; it has increased the demand for English meat, so that English meat is now "too fresh."

In continuation, M. de Loverdo says that, so far as France is concerned, Canadian competition need not be regarded as disquieting. Hungary and Servia have furnished some indications of ability to supply the London market with turkeys; but, owing to the great overland distance, the dead birds do not arrive in the best condition, while the use of refrigerators would put them in practically the same category as those from Canada.

Geese are less in favor with the British public than formerly; but there is a demand in excess of the home supply, especially at Christmas time, and France reaps this benefit almost exclusively, it being estimated that 100,000 to 150,000 are sold in London in December, while the other cities in England also furnish advantageous markets for geese. Sarthe geese have the highest reputation in London, the giant birds of Toulouse finding less favor. Geese should not exceed 9 to 12 pounds each in weight, and the tendency to produce Sarthe geese in excess of this size is discouraged. Southern Hungary has in recent years produced fine birds to compete, when dressed, with the French geese in London, but there is a reddening of the skin and a sensible depreciation in quality, due to the length of the transport. Russia has made some attempts, but produces only a mongrel, which fattens with difficulty.

Great Britain imported 16,000,000 great hundreds (1,920,000,000) of eggs in 1899. Many Russian eggs are credited to Germany, though originally coming from Russia, and many coming from Italy are credited to France and Belgium. French eggs would seem specially fitted for prompt consumption on account of the short transport, but, unfortunately for the French producers, an unwise practice has been adopted by many farmers, especially in Normandy, of keeping eggs many days or even weeks in the hope of getting better prices, and, as a result, the eggs have not reached London in perfect condition, and French eggs have become discredited. One large firm is quoted as spending not more than £30 a week where formerly £1,000 a week was spent, and this discrediting of French has happened at a time when other countries are perfecting their methods.

Denmark, exporting four times as much butter to England as France does, has applied to the egg trade those principles of cooperation which have already proved successful in the butter trade and other industries connected with agriculture. In the rural districts of the little Baltic Kingdom cooperative societies undertake the exportation of fresh eggs of a good quality, and members are required to scrupulously conform with the rules of the society. To ascertain, for example, by what member of the society a bad egg has been furnished, the shell of every egg is required to be marked with an india-rubber stamp, so that the person by whom the egg was supplied may be at once identified. Depots are established along the lines of the railway, and each producer is required to make a delivery of eggs at least three times a week. At each depot there is an agent of the society, who has the right to refuse any eggs about which suspicion arises or which are more than four days old. The approved eggs are sorted according to size. The inspection takes place with a lamp in a darkened chamber, and the discovery of a single rotten egg in London would be followed by a heavy claim against the Danish depot which furnished it. The Danish egg trade in England is growing tremendously, the English consumers appreciating their carefulness, and the Italians are imitating the Danish system, two centers of export having already been established on Danish principles. French producers are urged by M. de Loverdo to adopt the same system.

The following are the figures, in great hundreds of six score each, of the importation of eggs into the United Kingdom from France and Denmark, respectively:

Year.	France.	Denmark.
	Great hundreds.	*Great hundreds.*
1895	2,730,332	1,279,013
1896	3,275,776	1,566,623
1897	2,675,667	1,748,800
1898	2,115,098	2,019,508
1899	2,288,562	2,266,030

—(*Marshal Halstead, consul at Birmingham, in Consular Report, July, 1900.*)

Egg exports from Russia.—Consul-General Holloway sends from St. Petersburg, April 18, 1900, statement of the exportation of eggs from Russia during the period of 1872–1898, as follows:

Year.	Number.	Year.	Number.
1872	27,000,000	1886	331,000,000
1873	30,000,000	1887	505,000,000
1874	39,000,000	1888	684,000,000
1875	36,000,000	1889	609,000,000
1876	55,000,000	1890	755,000,000
1877	109,000,000	1891	833,000,000
1878	142,000,000	1892	739,000,000
1879	141,000,000	1893	785,000,000
1880	77,000,000	1894	955,000,000
1881	67,000,000	1895	1,411,000,000
1882	96,000,000	1896	1,475,000,000
1883	128,000,000	1897	1,737,000,000
1884	240,000,000	1898	1,831,000,000
1885	235,000,000		

The value in 1898 was 31,134,000 rubles ($16,002,876).—(*Consular Report*, *July*, *1900.*)

Meat in South Africa.—The recent action of the prime ministers of Cape Colony and Natal in suspending the duty on frozen and slaughter meat (the same being 4 cents per pound) has thus far conferred no benefit on consumers, particularly those at a distance from the seaports, and can not unless the duties on "canned meat" are suspended as well. Canned meat is, perhaps, the most important article of export from the United States to this country. The suspension of the duty on frozen meat should help the exporters of the United States; but, I regret to say, the lack of ships with cold-storage space prevents us from capturing any of this great trade. Over 4,000,000 pounds of frozen meat were sent to this country in 1898, not a pound of which came from the United States. The exportation of slaughter stock should be given prompt attention. The consumers not in reach of the refrigerator storage plants (which are at the seaports) obtain no advantage from the cheapening of frozen or chilled meat. There should now be on the water a large supply of slaughter stock. Australian stock is arriving, as well as shipments from the Argentine Republic.

Not one head of slaughter stock, or stock on the hoof, out of the several thousand received in 1898 came from the United States.

Frozen meat from Australia is sold cheaper than the meat of the Colony, which is rapidly disappearing, even with the old duty of 4 cents per pound in force. The suspension of the duty ought to put the price down to a point that will enable the poorest to supply themselves. The trade, however, prefers the slaughter stock at this time.

The act that provided for the suspension of the duty also provided for the issue of loans for cold-storage plants, to be built by anyone. The suspension of duty has a limitation, but the cold-storage provision will continue. The trade in chilled meat is in the hands of a monopoly.

I wish to call the attention of our cattle and sheep raisers to the fact that, while the United States has no refrigerator ships, plenty of ships can be chartered to bring good slaughter stock here. Horses and mules, which come in large numbers, reach this port in excellent condition without loss of weight, and it is to be presumed that the same would be true of slaughter cattle. It is stated that imported slaughter stock killed here gives better meat than even the live stock of the Colony.—(*J. G. Stowe, consul-general at Cape Town, in Consular Report, March, 1900.*)

The ingredients of oleomargarine.—Hon. G. W. Wilson, Commissioner of Internal Revenue, recently sent to Congress the following statement showing the quantities and kinds of ingredients used in the production of oleomargarine for the fiscal year ended June 30, 1899; also the percentage that each ingredient bears to the whole quantity:

Materials.	Pounds.	Percentage.
Neutral lard	31,297,251	34.27
Oleo oil	25,451,697	26.82
Cotton-seed oil	4,357,514	4.67
Sesame	494,910	.53
Coloring matter	148,970	.16
Sugar	110,164	.12
Glycerin	8,963	.01
Stearin	5,890	.07
Glucose	2,550	.02
Milk	14,200,575	15.57
Salt	6,773,670	7.42
Butter oil	4,342,904	4.76
Butter	1,568,319	1.72
Cream	3,527,410	3.86
Total	91,322,260	100.

Oleomargarine in France.—A recent trial of parties before the civil tribunal of Bordeaux, for having in possession and offering for sale as butter articles composed of other fatty substances, may be of interest to American manufacturers of such products. The defendants were fined 200 francs ($38.60) each, and one was fined 5 francs (96.5 cents) more for having issued bills of sale covering margarine without having specified the true character of the goods sold. The sentences were considered light, this being in the nature of a test case, from which the defendants appealed.

There have been of late several judgments of similar character in different departments of France. The law on which they are based is three years old, but hitherto there has been little evidence of its enforcement. It seems now that the law officers have received instructions to prosecute for an offense which has been so universal that it has been almost impossible to obtain genuine butter in many markets. What is the cause of the present activity I am unable to say. It may be because the trade in French butter with England was being affected or because the importation of oleomargarine is becoming prejudicial to the home market. Whatever the reason, it will be well for the American manufacturers exporting to France to label their products very clearly in French, giving on each package the name of manufacturer, place of manufacture, and weight of package, as well as name of product. Nothing must appear on the label which would cause one to infer that the article is, in whole or in part, butter. The term "butterine" or any English word suggesting butter should be avoided.

The terms of this law are very broad, and if the purpose of the Government is to put a stop to the sale of all products not made entirely of milk and cream, the provisions of the statute are such as to secure this result beyond a peradventure. It prohibits not only the sale or offering for sale as butter of all products not wholly composed of milk or cream, but makes every butter maker and butter seller liable for having such product in his possession, however the same may be labeled. If enforced, it will drive such compounds out of all groceries and markets where butter is offered for sale. As a consequence, all dealers in oleomargarine or any similar article, whether wholesalers or retailers, can not have genuine butter on the same or adjoining premises. If they deal in this product, which is not forbidden to be sold as such, it must be as a separate and independent trade. The terms of the law are wide enough to embrace hotel and restaurant keepers; but whether it will be enforced to that extent is not possible to predict. Strictly construed, it would effectually prevent not only dealers but users from having both butter and oleomargarine on their premises at the same time.

I am by no means sure that such absolute prohibition would be detrimental to trade in this product. An establishment keeping only this manufactured article, or a grocery keeping no butter but selling margarine of a good quality at a price notably lower than butter, which is very dear in this market, might be a success. The question is whether large consumers in hotels, restaurants, and pensions would be willing to proclaim that they furnish no butter to their patrons.—(*Albion W. Tourgée, consul at Bordeaux, in Consular Report, June, 1900.*)

The utilization of packing-house offal.—Mr. Phillip D. Armour, in a paper read before the convention of the National Live Stock Association at Fort Worth, Tex., in January, 1900, gave some interesting information in regard to the utilization of refuse by the large packing establishments and to the packing industry in general. He states that a 1,200-pound steer, live weight, will yield from 650 to 700 pounds of dressed beef. In the earlier history of the packing business most of the difference was lost, even the disposal of much of it being a source of actual cost to the packer. The blood was allowed to run into the river, but the heads, feet, tankage, and other refuse generally had to be hauled out on the prairie and buried in trenches. Then some few people began to see the value of this material, and it was dug up from the trenches and taken to factories for conversion into glue, oil, tallow, and fertilizer. The time soon came, however, when the packers found those who were willing to accept it free of cost, and later they were able to sell it instead of giving it away. Afterwards the packers realized the advantage of handling this refuse themselves so as to reduce the cost of their meat products; and so the saving of by-products has come to be quite an important feature of the packing business.

The horns of a slaughtered steer are cut off close to the head and the pith is removed and sent to the glue pot, while the horns themselves are dried, sorted into various grades, and shipped to the manufacturer. After being pressed into flat plates they are manufactured into combs, buttons, and ornaments of many kinds. The tips of the horns are made into mouthpieces for pipes, and the scraps are utilized by florists as fertilizers.

The bones are used in many ways. The knuckles are removed from the feet and shanks of the animal and, after boiling and cleaning, are used in the manufacture of knife handles, tooth brushes, buttons, and various articles in which ivory and bone are used. The hard bone is susceptible of a very fine polish and can hardly be distinguished from ivory. The scraps are used by manufacturers of bicycles and screws, for case-hardening steel, and are also used for poultry food.

From the blood the albumen is extracted by a chemical process and used for the fixing of colors in calico printing and also in the finishing of leathers. The residue of the blood goes into fertilizer.

The white hoofs are shipped to Japan and to Europe, to be made into buttons and ornaments of many kinds. Glues, gelatins, isinglass, etc., are manufactured from that portion of the hide not used for leather, and from sinews, cattle heads, cattle feet, calves' feet, etc. Tallow and grease are made into various grades of soap. Glycerin, a part of the fat that will not saponify, is recovered from the soap kettle and made into crude glycerin, dynamite glycerin, and chemically pure glycerin.

The hair is manufactured into felt, the cheaper grades of which are used for the insulation of refrigerator cars and ice boxes and for undercarpets, etc. The better grades are used in the manufacture of horse blankets, saddlery, felt boots, hats, etc. The tails of the cattle are used for manufacturing curled hair, in combination with horse hair, which is imported largely from Russia and South America.

One of the most valuable products of the steer is oleo oil, which is pressed from the fat. It is chemically butter fat. Much of it is shipped to Europe, where it enters into the manufacture of margarine, and it is also used in this country in the manufacture of oleomargarine and butterine.

All portions of the animal that may not be utilized for food or for commercial manufacture find their way back to the farm in the form of fertilizer. Pieces of meat, bones, etc., not available for food are boiled under high pressure to extract the grease and glue, and the residue is dried and enters into the composition of fertilizer.

Largest refrigerating plant in the world.—The Australasian Pastoralists' Review for October 15, 1900, states that there is being erected at Wellington, New Zealand, the largest refrigerating plant in the world. This plant will be capable of freezing 5,000 carcasses of sheep daily and will keep 100,000 sheep frozen in the storeroom.

Cape Angora goatskins.—Under the tariff act of 1897 raw goatskins with the hair on are free of duty, Angora goatskins of superior quality suitable for use as fur being provided for in paragraph 562 as "fur skins * * * not dressed in any manner and not specially provided for," and those of an inferior or bastard breed not suitable for such use being provided for in paragraph 664 as raw skins.—United States *v.* Bennet (66 Fed. Rep., 299; 13 C. C. A., 446) and Keen-Sutterle Company, Limited, *v.* United States (suit 2163, not yet reported) followed.—Compare In re Kirby (G. A., 4381.)

Before the United States General Appraisers at New York, February 18, 1901:

In the matter of the protests, 69448f–5608 and 70688f–8402, of Robert Crooks & Co., Knauth, Nachod & Kuhne, against the decision of the collector of customs at New York, N. Y., as to the rate and amount of duties chargeable on certain merchandise, imported per Mesaba and Statendam, and entered January 16 and March 14, 1900.

Opinion by SOMERVILLE, *General Appraiser.*

The merchandise covered by these protests consists of Cape of Good Hope Angora goatskins, raw, those covered by protest 69448f being of prime quality, and those by protest 70688f of an inferior kind of Angora goat, which comes from bastard goats of mixed breed.

The skins were returned free of duty, and the hair upon the skins was assessed at the rate of 11 cents per pound, under paragraphs 350, 357, and 360, tariff act of 1897.

Various claims are made in the protests, but those mainly relied on at the hearing are that these skins are free of duty (1) under paragraph 562 of said act as "fur skins of all kinds not dressed in any manner and not specially provided for," or (2) under paragraph 664 as "skins of all kinds, raw (except sheepskins with the wool on)."

It was held by the circuit court of appeals for the second circuit, in United States *v.* Bennet (66 Fed. Rep., 299; 13 C. C. A., 446), that raw Angora goatskins, which were used as fur skins, were free of duty under paragraph 588 of the tariff act of 1890 as "fur skins of all kinds not dressed in any manner," and that as to the hair its "classification for tariff purposes should not be under the head of 'wools,' because practically they are not such," as the court observed; for, "while bearing the name of 'wool,' they are not the wools to which the wool schedule relates, and it is too close an adherence to literalism to classify them as something which they are not." Note In re Fleet (G. A., 2880).

This decision was followed by the Board in the case of In re Kirby (G. A., 4381), arising under the tariff act of 1897, the Board using the following language:

> In our judgment, the view taken by the circuit court of appeals is rather strengthened than weakened by the change made by the substitution of paragraph 664 of the free list of the act of 1897 for the corresponding paragraph (605) of the act of 1890. The latter paragraph apparently excludes from the free list Angora goatskins with the wool on, by enumerating only such skins without the wool. Paragraph 664 of the present act, as above stated, exempts from duty "skins of all kinds, raw (except sheepskins with the wool on) * * * not specially provided for in this act." Raw Angora goatskins, not being sheepskins, would seem properly to fall under the provisions of the latter paragraph, unless specially provided for elsewhere in the act. However, being specially provided for as fur skins, "not dressed in any manner," as decided in the Bennet case, they must, in our judgment, be relegated to that paragraph for purposes of tariff classification. (Oppenheimer *v.* United States, 90 Fed. Rep., 796; Op. Atty. Gen., T. D., 15346.)
>
> It is a matter of common knowledge that there are some Angora goatskins, coming from an inferior breed of Angora goats, which are not used as fur skins, nor commercially known as such, and to these a different rule might apply. (Spon's Encyc. Manufactures, vol. 2, pp. 1095–1097.)
>
> Paragraph 383 of the tariff act of 1897, it may be observed, defining the word "wool," when used in connection with "a manufactured article of which it is a component material," and providing that it "shall be held to include" the hair of the goat, and other animals there named, can have no bearing on this case because the articles under consideration are mere raw unmanufactured articles, and do not fall within the purview of this paragraph.

Cape of Good Hope bastard skins were the subject of two decisions by the circuit court for the southern district of New York, in December, 1900, in the cases of Keen-Sutterle Company, Limited, *v.* United States, and Friel *v.* United States (suits 2163 and 1258, not yet reported).

These decisions were made by Townsend, J., that in the latter case being based on the ruling made in the former, the opinion in which is as follows:

> The merchandise in question comprises skins from the Cape of Good Hope, taken from the goats which are a cross between Cape of Good Hope and Persian, or Turk-

ish, Angora goats, and are commercially known as Cape bastard skins, or mixed, or Cape Angoras. They were imported with the hair attached and duty was assessed thereon at 12 cents per pound under paragraph 384 of the act of October 1, 1890, as class-two mohair. The importers protested, contending that they are free under the provisions of paragraph 605 of said act as skins. Said paragraph is as follows:

"605. Hides, raw or uncured, whether dry, salted, or pickled, Angora goatskins; raw, without the wool, unmanufactured, asses' skins, raw or unmanufactured, and skins, except sheepskins with the wool on."

The first contention of counsel for the Government is as to the sufficiency of the samples in evidence. It is unnecessary, however, to consider this contention, because it satisfactorily appears that the skins in question were not Angora goatskins at all and that the covering thereof was neither wool nor hair of the character of the hair of the Angora goat, but was a coarser hair, not suitable for spinning or for any of the purposes for which wool or Angora goat hair is used. The evidence shows that the hair in this case is only used for mixing with mortar and is comparatively valueless. All the commercial witnesses agree that these skins are not sufficiently close to those of the true Angora goat from Persia or Turkey to come within the class known as Angora goatskins. There is no provision for duty on hair when thus naturally a part of the imported goatskin. While crossing the Angora goat with the Cape goat improves the quality of the goatskin, the hair of the crossbreed does not have the woolly quality which gives value to that of the Angora goat. Inasmuch, therefore, as skins other than Angora goatskins without the wool are free under the provisions of paragraph 605 of said act, the decision of the Board of General Appraisers should be reversed.

The effect of these decisions was to hold that the articles then in question, though excluded from the provision in said paragraph 605 for "Angora goatskins, raw, without wool, unmanufactured," were nevertheless within the final provision in the same paragraph for "skins, except sheepskins with the wool on." A like conclusion was reached by the Secretary of the Treasury with reference to analogous provisions of the tariff act of 1882 (T. D. 7147).

It will be observed that the corresponding paragraph (664) of the present tariff act of 1897 has omitted the phrase "Angora goatskins, raw, without the wool;" and as thus amended places on the free list "skins of all kinds, raw (except sheepskins with the wool on)." The present act is, therefore, more favorable to the present contention of the importers than the analogous provisions of the tariff act of 1890. It should be noted also that, while the various paragraphs of the wool schedule (K) differentiate wools and the hair of various animals for dutiable purposes, paragraph 360 specifies only "wools on the skin" and makes no reference to hair of any kind. The logical inference from this is that it would seem to be not the intention of Congress to impose duty upon hair of this kind when imported on the skin.

We find accordingly that the so-called Angora goatskins of prime quality are suitable for fur purposes and are free of duty under said paragraph 562 as fur skins of the kind there provided for, and that those of an inferior or bastard breed are free of duty under said paragraph 664 as raw skins of the kind there provided for.

The protests are sustained and the collector's decision reversed with instructions to reliquidate the entries accordingly.

Exports of deerskins from British Columbia.—Consul A. E. Smith writes from Victoria concerning the exportation of deerskins as follows:

During the past year the exports of deerskins have been 20,000, much larger than for several years past, as owners had been holding them for better prices. These deerskins were of the average weight of 225 pounds per 100 skins, and were sold here at 18 and 19 cents per pound. They were all sent to the United States, principally to Portland, Oreg., and San Francisco.—(*Consular Report, August, 1900.*)

Export of bones and bone ash from Uruguay.—Inquiry has frequently been made as to the export of bones and bone ash from the Republic of Uruguay by manufacturers of animal fertilizers and others, and the following will answer the questions in detail.

Crude bones are exported from Uruguay in large quantities, the statistics showing for the years named these results:

Year.	Total export.		To United States.	
	Kilograms.	*Pounds.*	*Kilograms.*	*Pounds.*
1896	17,174,054	37,861,919	2,129,610	4,694,938
1897	17,244,477	38,017,174	4,389,704	9,677,541
1898	13,460,616	29,675,274	2,258,983	4,980,044
1899	18,410,415	40,587,601	2,092,001	4,612,025

Countries other than the United States taking this product are given as follows:

Country.	1896.		1897.		1898.	
	Kilograms.	*Pounds.*	*Kilograms.*	*Pounds.*	*Kilograms.*	*Pounds.*
England	10,506,058	23,161,655	10,674,994	23,534,092	5,521,317	1,217,638
Italy	3,240,048	7,143,010	3,144,739	6,932,892	884,421	1,949,795
France	594,264	1,210,907	34,300	75,618	1,496,379	3,298,917
Brazil	95,565	210,683	...	...	283,347	724,667
Spain	271,880	599,387	...	...	...	...
Belgium	202,500	446,432	152,539	336,287	32,098	70,763
Germany	247,996	546,732	212,034	467,450	319,374	704,092

These exportations are from Paysandu, Fray-Bentos, and other ports, but the greatest amount is from Montevideo. Bone ash is generally exported in "granel," by round charter of a sailing vessel to the destined port, though tramp steamers take it for Europe in the absence of something more desirable. If sent by steamer, it must be bagged. Grease is largely removed from the bones coming from the slaughterhouses, but bones from the country are carefully saved and dried, and find a ready market. Selections are made, for commercial purposes, from the bones before they go on the market for fertilizers, these being sent almost exclusively to Europe. The price per ton for fertilizer bones varies, but is now quoted at $18.75 per ton for slaughterhouse and $19.50 per ton for "camp" dried, free on board.

Many thousands of horns go to the United States, the export value for 1899 being $24,067.20. Animal fertilizers are not used in the Republic, save in a small way by vine growers, who use the ashes for the vineyards.

Freight per ton on bones to the Atlantic ports of the United States is now quoted at $4.50, sail. Horns, generally carried by steamers, go at $6 per 1,000 kilograms (2,204.6 pounds), but must be bagged.

The bone ash of Uruguay is made at the "saladeras" (slaughterhouses), where the bones and waste, after tanking for grease, are used for fuel in making steam. Coal is all imported from Europe—Wales or Cardiff—and costs at the boiler not less than $9.25 per ton. The bones and waste give needed power, and, as bone ash, find a market at an average value here of $6 per ton.—(*Albert W. Swalm, consul at Montevideo, in Consular Report, August, 1900.*)

Egg exports from Madeira.—The following has been received from Consul Jones, of Funchal, dated May 5, 1900:

The export of eggs from Madeira to South Africa since 1897 has been:

1897	2,122,286
1898	4,054,826
1899	5,298,820
1900 (from January 1 to April 1)	2,067,000

The United States should command this trade. Madeira is fourteen days from Cape Town. Eggs are put up and shipped from here in the most primitive manner. With our advanced means of preserving and methods of carrying, our eggs should command a better price, and the market is without limit. Eggs could be shipped from America via Southampton to catch the fast-mail steamers, and would be only a week older than Madeira eggs when they arrive at destination. Eggs are taken from central Russia to South Africa, arriving there in good condition. Eggs sell in the market here at $3 per hundred.—(*Consular Report, August, 1900.*)

Horse and dog meat as food in Germany.—Consul-General Guenther writes from Frankfort, May 26, 1900:

On account of the high price of other meat, not only horse meat but also dog meat is used by people as an article of food in Germany. The new meat-inspection bill (called here "a law to raise the price of meat") does not adequately protect the consumer against bad meat, but excludes many first-class products from the country.

According to the statistical yearbook of German cities, it appears that the consumption of horse meat is on the increase, and in Breslau, Chemnitz, Dresden, Leipzig, Zwickau, and other places dogs are slaughtered for food.—(*Consular Report, September, 1900.*)

Muzzling of dogs in Germany and Great Britain.—At the instance of the Commissioners of the District of Columbia a Department instruction was sent to certain consular officers in Europe, asking whether dogs are required to be muzzled in foreign cities, and if the results have proved satisfactory. In reply, Consul-General Mason writes from Berlin:

"In Berlin, Frankfort, and, so far as I know or can ascertain, in all cities and large towns of Germany dogs are required to be muzzled whenever they are on the street or public place, and this regulation is enforced in cities even when the dog is led or held in leash by the owner or is harnessed for working purposes to a cart or other vehicle.

"In Berlin every dog is subject to a tax of 20 marks ($4.76) per annum. When this tax is paid, the dog is registered and the owner receives a small brass disk, bearing the registered number of the animal, which must thenceforth be worn on its collar.

"The absence of either number or muzzle subjects the dog, when outside the inclosed premises of its owner, to immediate seizure by the dog police, who are a special branch of the municipal police, appointed and qualified for that purpose.

"The Berlin ordinance covering this subject was enacted many years ago, but was amended to its present form on March 5, 1899. The following is a translation of section 7, which relates to the penalties that apply to dogs found in the streets or public places without muzzles, the fine for each offense which does not involve willful intent or neglect on the part of the owner being 3 marks (75 cents):

"Dogs not wearing muzzles and valid tax certificates, found in public places, are to be seized, in so far as the exceptional conditions named hereinafter do not exist.

"The muzzle must be fastened around the head according to prescribed rule. If the muzzle hangs down from the neck, it is to be considered as if it did not exist.

"The capture of dogs with defective muzzles is permitted only when the defect or injury to the muzzle leaves it possible for the dog to bite.

"Disputes and differences of opinion between the dog-catching official and the leader of the dog are decided upon demand at the nearest police station.

"Dogs which are not three months old are not to be seized.

"As in many instances it is impossible to ascertain the exact age of such a dog, the animal is to be seized only when there can be no doubt as to the age of the dog.

"The effect of these regulations has been practically to exterminate stray and useless dogs; to restrict the dogs actually kept (1) to those of fine race, owned by people in easy circumstances; (2) to those kept for hunting; and (3) to those as working animals by milkmen, market men, butchers, peddlers, etc., in or near towns and cities.

"The ordinance is enforced with unswerving vigor and impartiality, and as a consequence hydrophobia is practically unknown in Germany.

Consul-General Osborne responds from London that he submitted the questions of the Department to the board of agriculture, and they sent him copy of the rabies acts and a tabular statement of the number of cases in London during 1897, 1898, and 1899, showing that the operations of the board, following upon the steps which had been taken by the local authorities of London to eradicate the disease, were attended with such success that no case of rabies has occurred within that area during the past year.

The regulations governing the muzzling of dogs are summarized as follows:

Any unmuzzled dog found by the police in a public place, not under the control of any person and not wearing a collar with the name and address of the owner, will be seized by the police, and the owner will be liable to a penalty not exceeding £20 ($97).

No dog shall be allowed to be in or on any place unless such dog is muzzled with a strong cage muzzle, so constructed as to render it impossible for the dog to bite, but so as not to prevent it breathing freely or lapping water.

Any dog not muzzled may be seized, and if diseased, it shall be slaughtered; if suspected, it shall be detained or dealt with as the council thinks expedient; if it is not diseased or suspected, it shall be detained for three days, and, if not then claimed by the owner, shall be slaughtered or disposed of as the council deems expedient. In addition to any penalty the owner may be liable to for a breach of these regulations, all expenses connected with such detention may be recovered from the owner.

The foregoing regulations shall not apply—

(*a*) To any dog under the control of any person and wearing a collar upon which the name and address of the owner are legibly inscribed.

(*b*) To sheep dogs with a shepherd and in charge of sheep.

(*c*) To dogs being taken to or from exhibitions, shows, or other places, if confined in boxes, cages, or hampers so constructed as to render it impossible for them to bite.

(*d*) To packs of hounds while being used for sporting purposes or while being exercised under the control of servants of the hunt.

The expression "public place" in these regulations includes any street, thoroughfare, public bridge, park, garden, or pleasure ground, uninclosed land, or other place to which the public for the time being has access.

—(*Consular Report*, *August*, *1900.*)

THE IMPERIAL GERMAN MEAT INSPECTION LAW.

The German meat inspection law, which is given here in both the English and the German text, is also issued as Circular No. 32 of this Bureau. It is hardly necessary to remind exporters that in interpreting the law the German courts will follow the German version. In order to obviate the appearance of giving an interpretation to the law, the translator has found it necessary to hold as closely as possible to a literal translation, taking into consideration those conditions in Germany which differ from those in America. Accordingly, English rhetoric has been made secondary to a proper rendering of the sense of the German words in English. Nevertheless, there are some words and expressions in the original the meaning of which is not absolutely clear and the interpretation of these will probably rest with the courts.

[*Translation.*]

An act concerning the inspection of animals to be slaughtered [food animals] and of meat, June 3, 1900.

We, William, by the grace of God German Emperor, King of Prussia, etc., decree in the name of the Empire, the assent of the Federal Council and of the Reichstag having been obtained, what follows:

§ 1.

Neat cattle, swine, sheep, goats, horses, and dogs, the meat of which is intended to be used as food for man, shall be subjected to an official inspection both before and after slaughter. By decision of the Federal Council [Bundesrath] the obligatory inspection may be extended to other food animals.

In case of emergency slaughter, the antemortem inspection may be omitted.

The following are to be considered as cases of emergency: When there is reason to fear that the animal may die before the arrival of the competent [proper local] inspector, or that the meat may become materially reduced in value owing to aggravation of the diseased condition, or when, in consequence of an accident, the animal must be killed immediately.

§ 2.

In the case of food animals the meat of which is intended to be used exclusively in the owner's own household the antemortem inspection may be omitted whenever the animals do not present any signs of disease which would exclude the fitness of their meat as food; the postmortem inspection also may be omitted whenever such indications of disease are likewise not revealed during the killing and dressing.

Traffic in meat the inspection of which has been on the ground of § 2, paragraph 1, is forbidden.

As "own household" in the sense of § 2, paragraph 1, are not to be considered: The household of the barracks, hospitals, educational institutions, eating establishments, prisons, almshouses, and similar institutions, nor the household of the butchers, meat dealers, nor of hotel, saloon, and restaurant keepers.

§ 3.

The [respective] federated governments are authorized to order the inspection, at places where and times when a communicable [epizootic] animal disease prevails, of all food animals exposed to said disease.

§ 4.

Meats, in the sense of this law, are fresh or prepared parts of warm-blooded animals, so far as said parts are edible. As "parts" are also considered fats and sausages prepared from warm-blooded animals; other products, however, only so far as the Bundesrath orders.

§ 5.

In order to accomplish the inspections, inspection districts shall be established; for each of said districts shall be appointed at least one inspector and one deputy inspector.

The establishment of the inspection districts and the appointment of the inspectors devolve upon the federated governmental authorities. For the inspections to be performed in the military preserved meat factories there may be special inspectors appointed by the military authorities.

As inspectors are to be appointed officially recognized veterinarians or other persons who have demonstrated a sufficient knowledge.

§ 6.

If from the inspections there is shown the presence or the suspicion of a disease, for which compulsory notification exists, action is to be taken in accordance with the regulations in force governing the case at hand.

§ 7.

If the antemortem inspection does not furnish any ground for preventing the slaughtering, the inspector shall permit it to take place under any special precautions which in his judgment should be adopted.

The slaughter of the animal presented for inspection shall not take place before permission is given, and then only under the special precautionary measures ordered.

If the slaughter does not take place at latest two days after permission is given, then it shall be allowable only after a reinspection and a second permission.

§ 8.

If the postmortem inspection shows no ground for the condemnation of the meat, the inspector shall declare it as fit for consumption by man.

Before the inspection, parts of a slaughtered animal shall not be taken away.

§ 9.

If the inspection shows that the meat is unfit as food for man, then the inspector shall place a provisional embargo upon it, inform the owner of this fact, and shall immediately give notice to the police authorities.

Meat the unwholesomeness of which has been established by the inspection shall not be brought into traffic as nutriment or food for man.

The use of this meat for other purposes may be permitted by the police authorities so far as sanitary considerations do not contraindicate. The police authorities shall determine what precautionary measures are to be adopted in order to prevent the use of such meats as food for man.

This meat shall not be brought into traffic without permission from the police, and then only under the precautionary measures prescribed by the police authorities.

This meat shall be disposed of by the police authorities in such manner that it can do no harm, so far as its use for other purposes [§ 9, paragraph 3] is not permitted.

§ 10.

If the inspection shows that the meat is only conditionally fit as food for man, then the inspector shall place a provisional embargo upon it, shall inform the owner of this fact, and shall immediately give notice to the police authorities. The latter shall determine under what safeguarding measures the meat can be made fit for human food.

Meat which has thus been recognized as only conditionally fit [for nutriment and food for man] shall not be brought into traffic as nutriment and food for man before it has been made fit for human food by the safeguarding measures prescribed by the police authorities.

So far as such action of making the meat fit for food is not taken, the provisions of § 9, paragraphs 3 to 5, shall apply.

§ 11.

Dealing in meat thus made fit as food for man [§ 10, paragraph 1] can take place only under a designation making this condition recognizable.

Dealing in and use of such meat by meat dealers and hotel, saloon, and restaurant keepers are allowed only on license from the police authorities. This license shall be revokable at any time. Such meat shall be delivered to the above-mentioned tradespeople only so far as such a license has been granted to them. In the business rooms of these persons it must be made especially evident by means of an intelligible sign in a conspicuous place that meat of the quality designated in paragraph 1 [§ 11] is sold or used.

Meat dealers shall not offer for sale nor sell this quality of meat in the same rooms in which [unconditionally] wholesome meat [§ 8] is offered for sale or sold.

§ 12.

The importation past the customs line of meat in hermetically sealed cans, or in other similar vessels, of sausages and other mixtures made from chopped meat is prohibited.

As for all other meats, the following provisions relative to their importation past the customs line shall be in force until December 31, 1903:

1. Fresh meat may be imported past the customs line only in entire carcasses, but the carcasses of neat cattle (with the exception of calves) and of swine may be cut into halves.

The pleura and peritoneum, lungs, heart, kidneys, and, in case of cows, the udder also, must be attached to the carcass in natural connection. The Bundesrath is authorized to extend this provision to further organs.

2. Prepared meat may be imported only when from its origin and its preparation danger to human health is, as shown by experience, excluded, or when, at the time of importation, its harmlessness to man's health can be determined in a reliable manner. This determination is to be considered impracticable, especially in shipments of pickled meats [Pöckelfleisch], when the weight of single pieces is less than four kilograms [8.8 pounds avoirdupois]. This order does not apply to hams, bacon, and casings.

Meat which, although subjected to a preserving process, has practically retained the properties of fresh meat, or which, through suitable treatment, can recover those properties, is not to be considered as prepared meat. Such meat comes under the provisions of number 1 [fresh meats].

After December 31, 1903, the conditions governing the importation of meat are to be determined anew by law. If no new law is enacted by the time mentioned, the regulations established by § 12, paragraph 2, shall remain in force until further measures are adopted.

§ 13.

Meat passing the customs line shall be subject, upon its importation, to an official inspection made with the cooperation of the customs authorities. Excepted herefrom is such meat as is proved to have already been inspected, according to regulations, in the inland [inside the customs line] and meat intended for shipment in direct transit.

The importation of meat shall take place only via certain customs-houses. The Bundesrath shall determine these customs-houses, and also the customs and revenue offices where the inspection of the meat may take place.

§ 14.

For game and fowls and, further, for meat taken along for use on journeys, the provisions of §§ 12 and 13 shall be applicable only so far as the Bundesrath orders.

For meat imported in the minor frontier trade, as well as in the trade of the fairs and markets of frontier districts, exceptions to the regulations of §§ 12 and 13 may be made by order of the [separate] federated governments.

§ 15.

The Bundesrath is authorized to decree more far-reaching prohibitions and restrictions of importation than are provided in §§ 12 and 13.

§ 16.

The provisions of § 8, paragraph 1, and of §§ 9 to 11 apply also to meat imported inside of the customs line. Instead of the innocuous disposal [see § 9, paragraph 5] or of the safeguarding measures ordered by the police, the reexportation of the meat may, however, be permitted under corresponding precautionary measures, so far as hygienic considerations do not contraindicate.

§ 17.

Meat which is not intended as food for man but which can be so used may be imported without inspection, after it has been rendered unfit for human food.

§ 18.

The inspection (§ 1) of horses must be made by officially recognized veterinarians.

Dealing in horse meat as well as the importation of such meat inside of the customs line shall take place only under a designation, in the German language, which makes the meat recognizable as horse meat.

Dealing in and the use of horse meat shall be permitted to meat dealers and hotel, saloon, and restaurant keepers only with a license from the police authorities; the license shall be revocable at any time. Horse meat may be delivered to the above-named tradespeople only so far as such a license has been granted to them. In the business rooms of these persons it must be made especially evident by means of an intelligible sign in a conspicuous place that horse meat is dealt in or used.

Meat dealers shall not offer for sale nor sell horse meat in the same rooms in which meat from other animals is offered for sale or sold.

The Bundesrath is authorized to order that the above regulations be applied to asses, mules, dogs, and other animals which are more rarely slaughtered.

§ 19.

The inspector shall clearly indicate upon the meat the result of the inspection. Meat imported from abroad is, in addition, to be clearly indicated as imported meat.

The Bundesrath shall determine the kind of mark [to be used].

§ 20.

Meat which has been subjected within the [German] Empire to the official inspection according to §§ 8 to 16 may be made subject to an official reinspection only for the purpose of determining whether it has spoiled in the meantime or whether it has otherwise suffered any change in its condition rendering it injurious to health.

Enactments of the [separate] federated governments, according to which, for communities with public slaughterhouses, the dealing in fresh meat may be subjected to restrictions, especially to the obligatory inspection within the community, shall remain uninfluenced, with the proviso that their applicability shall not be made dependent upon the origin of the meat.

§ 21.

In the industrial preparation of meat no materials or kinds of processes shall be used which are capable of imparting to the wares a condition injurious to health. It is forbidden to import from abroad such prepared meat or to offer it for sale, to sell it, or otherwise to bring it into traffic.

The Bundesrath shall determine the materials and the kinds of processes to which these regulations shall be applied.

The Bundesrath shall order how far the regulations of paragraph 1 are applicable also to special materials and kinds of processes which are apt to conceal an unwholesome or inferior quality of the wares.

§ 22.

The Bundesrath is authorized:

1. To issue regulations relative to determining whether persons possess sufficient knowledge [§ 5] to act as meat inspectors.

2. To establish general principles, according to which the inspection of food animals and of meat is to be carried out and for the further treatment of the food animals and of the meat in case they are not passed [in accordance with § 8].

3. To make the necessary arrangements for carrying out the provisions of § 12 and for determining the fees for the inspection of meat brought inside the customs line.

§ 23.

The laws of the [separate] federated governments determine who has to bear the cost of the official inspection (§ 1). In all other matters the necessary regulations for carrying out the law shall be issued by the governments of the [separate] federated States, so far as the Bundesrath has not been declared competent [responsible] or in so far as the Bundesrath makes no use of the authority conferred upon it by § 22.

§ 24.

Regulations of the [separate] federated governments in regard to trichina inspection and the dealing in and use of meat which, although fit as food for man, is considerably diminished in its nutritive and food value; further, regulations of the [separate] federated governments establishing more far-reaching obligations than does this law relative to:

1. The animals to be subjected to the inspection.

2. The carrying out of the inspections by officially recognized veterinarians

3. The dealing in rejected meat, or of meat of animals designated in § 18, are permissible on the condition that their applicability shall not be made dependent upon the place of origin of the food animal or of the meat.

§ 25.

The Bundesrath shall determine how far the provisions of this law apply to meat imported into that part of the Empire situated outside of the customs line.

§ 26.

Imprisonment in jail not exceeding six months and a fine not exceeding one thousand five hundred marks, or either of these penalties, shall be imposed upon—

1. Any person who knowingly acts in contravention of § 9, paragraphs 2, 4; § 10, paragraphs 2, 3; § 12, paragraph 1; or § 21, paragraphs 1, 2; or of a prohibition based upon § 21, paragraph 3.

2. Any person who shall knowingly bring into traffic as nutriment or food for man meat which has been imported contrary to regulations of § 12, paragraph 1, or meat which has been rendered unfit for human food according to § 17.

3. Any person who shall fraudulently affix or alter the marks provided for in § 19, or who shall knowingly offer for sale or sell meat on which the marks have been fraudulently affixed, altered, or removed.

§ 27.

A fine, not exceeding one hundred and fifty marks, or imprisonment will be imposed upon—

1. Any person who, through carelessness, shall commit one of the acts designated in § 26, numbers 1 and 2.

2. Any person who shall undertake to slaughter an animal before it has been subjected to the inspection prescribed in this law, or [to an inspection] ordered on authority of § 1, paragraph 1, sentence 2; § 3; § 18, paragraph 5, or § 24.

3. Any person who shall bring into traffic meat before it has been subjected to the inspection prescribed in this law or ordered on authority of § 1, paragraph 1, sentence 2; § 3; § 14, paragraph 1; § 18, paragraph 5, or § 24.

Any person who shall act in contravention of § 2, paragraph 2; § 7, paragraphs 2, 3; § 8, paragraph 2; § 11; § 12, paragraph 2; § 13, paragraph 2; § 18, paragraphs 2 to 4; also, any person who shall contravene orders issued in accordance with § 15, or § 18, paragraph 5, or the regulations of the [separate] federated governments concerning the dealing in and the use of meat, issued on authority of § 24.

§ 28.

In the cases [provided for] in § 26, numbers 1 and 2, and in § 27, number 1, the confiscation of the meat shall be ordered in addition to the penalty. In cases [provided for] in § 26, number 3, and § 27, numbers 2 to 4, the seizure of the meat or of the animal may be ordered in addition to the penalty. In the case of confiscation, it is immaterial whether the object seized belongs to the condemned person or not.

If the prosecution or the condemnation of a given person is not possible, then the seizure may be ordered independently.

§ 29.

The provisions of the law of May 14, 1879 (page 145, Reichs-Gesetzbl.), regarding the traffic in nutriments, foods, and articles of use remain unchanged. The provisions of § 16 of said law shall also be applicable to offenses against the provisions of the present law.

§ 30.

Those provisions of this law which relate to the adoption of the arrangements necessary for carrying out the law for the inspection of food animals and of meat shall take effect on the day of the promulgation of this law.

As for the remainder, the time when the law goes into effect, either wholly or in part, shall be fixed by an imperial order with the assent of the Bundesrath.

In witness whereof, under our own signature and with the imperial seal,

Given at the New Palace, June 3, 1900.

[L. S.] (Signed) WILLIAM.
(Signed) PRINCE OF HOHENLOHE.

Reichs-Gesetzblatt, No. 27.

No. 2692. Gesetz, betreffend die Schlachtvieh und Fleischbeschau. Vom 3. Juni 1900.

Wir, Wilhelm, von Gottes Gnaden Deutscher Kaiser, König von Preussen, &c. verordnen im Namen des Reichs, nach erfolgter Zustimmung des Bundesraths und des Reichstags, was folgt:

§. 1.

Rindvieh, Schweine, Schafe, Ziegen, Pferde und Hunde, deren Fleisch zum Genusse für Menschen verwendet werden soll, unterliegen vor und nach der Schlachtung einer amtlichen Untersuchung. Durch Beschluss des Bundesraths kann die Untersuchungspflicht auf anderes Schlachtvieh ausgedehnt werden.

Bei Nothschlachtungen darf die Untersuchung vor der Schlachtung unterbleiben.

Der Fall der Nothschlachtung liegt dann vor, wenn zu befürchten steht, dass das Thier bis zur Ankunft des zuständigen Beschauers verenden oder das Fleisch durch Verschlimmerung des krankhaften Zustandes wesentlich an Werth verlieren werde oder wenn das Thier in Folge eines Unglücksfalls sofort getödtet werden muss.

§. 2.

Bei Schlachtthieren, deren Fleisch ausschliesslich im eigenen Haushalte des Besitzers verwendet werden soll, darf, sofern sie keine Merkmale einer die Genusstauglichkeit des Fleisches ausschliessenden Erkrankung zeigen, die Untersuchung vor der Schlachtung und, sofern sich solche Merkmale auch bei der Schlachtung nicht ergeben, auch die Untersuchung nach der Schlachtung unterbleiben.

Eine gewerbsmässige Verwendung von Fleisch, bei welchem auf Grund des Abs. 1 die Untersuchung unterbleibt, ist verboten.

Als eigener Haushalt im Sinne des Abs. 1 ist der Haushalt der Kasernen, Krankenhäuser, Erziehungsanstalten, Speiseanstalten, Gefangenanstalten, Armenhäuser und ähnlicher Anstalten sowie der Haushalt der Schlächter, Fleischhändler, Gast-, Schank- und Speisewirthe nicht anzusehen.

§. 3.

Die Landesregierungen sind befugt, für Gegenden und Zeiten, in denen eine übertragbare Thierkrankheit herrscht, die Untersuchung aller der Seuche ausgesetzten Schlachtthiere anzuordnen.

§. 4.

Fleisch im Sinne dieses Gesetzes sind Theile von warmblütigen Thieren, frisch oder zubereitet, sofern sie sich zum Genusse für Menschen eignen. Als Theile gelten auch die aus warmblütigen Thieren hergestellten Fette und Würste, andere Erzeugnisse nur insoweit, als der Bundesrath dies anordnet.

§. 5.

Zur Vornahme der Untersuchungen sind Beschaubezirke zu bilden; für jeden derselben ist mindestens ein Beschauer sowie ein Stellvertreter zu bestellen.

Die Bildung der Beschaubezirke und die Bestellung der Beschauer erfolgt durch die Landesbehörden. Für die in den Armeekonservenfabriken vorzunehmenden Untersuchungen können seitens der Militärverwaltung besondere Beschauer bestellt werden.

Zu Beschauern sind approbirte Thierärzte oder andere Personen, welche genügende Kenntnisse nachgewiesen haben, zu bestellen.

§. 6.

Ergiebt sich bei den Untersuchungen das Vorhandensein oder der Verdacht einer Krankheit, für welche die Anzeigepflicht besteht, so ist nach Massgabe der hierüber geltenden Vorschriften zu verfahren.

§. 7.

Ergiebt die Untersuchung des lebenden Thieres keinen Grund zur Beanstandung der Schlachtung, so hat der Beschauer sie unter Anordnung der etwa zu beobachtenden besonderen Vorsichtsmassregeln zu genehmigen.

Die Schlachtung des zur Untersuchung gestellten Thieres darf nicht vor der Ertheilung der Genehmigung und nur unter Einhaltung der angeordneten besonderen Vorsichtsmassregeln stattfinden.

Erfolgt die Schlachtung nicht spätestens zwei Tage nach Ertheilung der Genehmigung, so ist sie nur nach erneuter Untersuchung und Genehmigung zulässig.

§. 8.

Ergiebt die Untersuchung nach der Schlachtung, dass kein Grund zur Beanstandung des Fleisches vorliegt, so hat der Beschauer es als tauglich zum Genusse für Menschen zu erklären.

Vor der Untersuchung dürfen Theile eines geschlachteten Thieres nicht beseitigt werden.

§. 9.

Ergiebt die Untersuchung, dass das Fleisch zum Genusse für Menschen untauglich ist, so hat der Beschauer es vorläufig zu beschlagnahmen, den Besitzer hiervon zu benachrichtigen und der Polizeibehörde sofort Anzeige zu erstatten.

Fleisch, dessen Untauglichkeit sich bei der Untersuchung ergeben hat, darf als Nahrungs- oder Genussmittel für Menschen nicht in Verkehr gebracht werden.

Die Verwendung des Fleisches zu anderen Zwecken kann von der Polizeibehörde zugelassen werden, soweit gesundheitliche Bedenken nicht entgegenstehen. Die Polizeibehörde bestimmt, welche Sicherungsmassregeen gegen eine Verwendung des Fleisches zum Genusse für Menschen zu treffen sind.

Das Fleisch darf nicht vor der polizeilichen Zulassung und nur unter Einhaltung der von der Polizeibehörde angeordneten Sicherungsmassregeln in Verkehr gebracht werden.

Das Fleisch ist von der Polizeibehörde in unschädlicher Weise zu beseitigen, soweit seine Verwendung zu anderen Zwecken (Abs. 3) nicht zugelassen wird.

§. 10.

Ergiebt die Untersuchung, dass das Fleisch zum Genusse für Menschen nur bedingt tauglich ist, so hat der Beschauer es vorläufig zu beschlagnahmen, den Besitzer hiervon su benachrichtigen und der Polizeibehörde sofort Anzeige zu erstatten. Die Polizeibehörde bestimmt, unter welchen Sicherungsmassregeln das Fleisch zum Genusse für Menschen brauchbar gemacht werden kann.

Fleisch, das bei der Untersuchung als nur bedingt tauglich erkannt worden ist, darf als Nahrungs- und Genussmittel für Menschen nicht in Verkehr gebracht werden, bevor es unter den von der Polizeibehörde angeordneten Sicherungsmassregeln zum Genuss für Menschen brauchbar gemacht worden ist.

Insoweit eine solche Brauchbarmachung unterbleibt, finden die Vorschriften des §. 9 Abs. 3 bis 5 entsprechende Anwendung.

§. 11.

Der Vetrieb des zum Genusse für Menschen brauchbar gemachten Fleisches (§. 10 Abs. 1) darf nur unter einer diese Beschaffenheit erkennbar machenden Bezeichnung erfolgen.

Fleischhändlern, Gast-, Schank- und Speisewirthen ist der Vertrieb und die Verwendung solchen Fleisches nur mit Genehmigung der Polizeibehörde gestattet; die Genehmigung ist jederzeit widerruflich. An die vorbezeichneten Gewerbetreibenden darf derartiges Fleisch nur abgegeben werden, soweit ihnen eine solche Genehmigung ertheilt worden ist. In den Geschäftsräumen dieser Personen muss an einer in die Augen fallenden Stelle durch deutlichen Anschlag besonders erkennbar gemacht werden, dass Fleisch der im Abs. 1 bezeichneten Beschaffenheit zum Vertrieb oder zur Verwendung kommt.

Fleischhändler dürfen das Fleisch nicht in Räumen feilhalten oder verkaufen, in welchen taugliches Fleisch (§. 8) feilgehalten oder verkauft wird.

§. 12.

Die Einfuhr von Fleisch in luftdicht verschlossenen Büchsen oder ähnlichen Gefässen, von Würsten und sonstigen Gemengen aus zerkleinertem Fleisch in das Zollinland ist verboten.

Im Uebrigen gelten für die Einfur von Fleisch in das Zollinland bis zum 31. Dezember 1903 folgende Bedingungen:

1. Frisches Fleisch darf in das Zollinland nur in ganzen Thierkörpern, die bei Rindvieh, ausschliesslich der Kälber, und bei Schweinen in Hälften zerlegt sein können, eingeführt werden.

   Mit den Thierkörpern müssen Brust und Bauchfell, Lunge, Herz, Nieren, bei Kühen auch das Euter in natürlichem Zusammenhang verbunden sein; der Bundesrath ist ermächtigt, diese Vorschrift auf weitere Organe auszudehnen.

2. Zubereitetes Fleisch darf nur eingeführt werden, wenn nach der Art seiner Gewinnung und Zübereitung Gefahren für die menschliche Gesundheit erfahrungsgemäss ausgeschlossen sind oder die Unschädlichkeit für die menschliche Gesundheit in zuverlässiger Weise bei der Einfuhr sich feststellen lässt. Diese Feststellung gilt als unausführbar insbesondere bei Sendungen von Pöckelfleisch, sofern das Gewicht einzelner Stücke weniger als vier Kilogramm beträgt; auf Schinken, Speck und Därme findet diese Vorschrift keine Anwendung.

   Fleisch, welches zwar einer Behandlung zum Zwecke seiner Haltbarmachung unterzogen worden ist, aber die Eigenschaften frischen Fleisches im Wesentlichen behalten hat oder durch entsprechende Behandlung wieder gewinnen kann, ist als zubereitetes Fleisch nicht anzusehen; Fleisch solcher Art unterliegt den Bestimmungen in Ziffer 1.

Für die Zeit nach dem 31. Dezember 1903 sind die Bedingungen für die Einfuhr von Fleisch gesetzlich von Neuem zu regeln. Sollte eine Neuregelung bis zu dem bezeichneten Zeitpunkte nicht zu Stande kommen, so bleiben die im Abs. 2 festgesetzten Einfuhrbedingungen bis auf Weiteres massgebend.

§. 13.

Das in das Zollinland eingehende Fleisch unterliegt bei der Einfuhr einer amtlichen Untersuchung unter Mitwirkung der Zollbehörden. Ausgenommen hiervon ist das nachweislich im Inlande bereits vorschriftsmässig untersuchte und das zur unmittelbaren Durchfuhr bestimmte Fleisch.

Die Einfuhr von Fleisch darf nur über bestimmte Zollämter erfolgen. Der Bundesrath bezeichnet diese Aemter sowie diejenigen Zoll- und Steuerstellen, bei welchen die Untersuchung des Fleisches stattfinden kann.

§. 14.

Auf Wildpret und Federvieh, ferner auf das zum Reiseverbrauch mitgeführte Fleisch finden die Bestimmungen der §§. 12 und 13 nur insoweit Anwendung, als der Bundesrath dies anordnet.

Für das im kleinen Grenzverkehr sowie im Mess- und Marktverkehr des Grenzbezirkes eingehende Fleisch können durch Anordnung der Landesregierungen Ausnahmen von den Bestimmungen der §§. 12 and 13 zugelassen werden.

§. 15.

Der Bundesrath ist ermächtigt, weitergehende Einfuhrverbote und Einfuhrbeschränkungen, als in den §§. 12 und 13 vorgesehen sind, zu beschliessen.

§. 16.

Die Vorschriften des §. 8 Abs. 1 und der §§. 9 bis 11 gelten auch für das in das Zollinland eingehende Fleisch. An Stelle der unschädlichen Beseitigung des Fleisches oder an Stelle der polizeilicherseits anzuordnenden Sicherungsmassregeln kann jedoch, insoweit gesundheitliche Bedenken nicht entgegenstehen, die Wiederausfuhr des Fleisches unter entsprechenden Vorsichtsmassnahmen zugelassen werden.

§. 17.

Fleisch, welches zwar nicht für den menschlichen Genuss bestimmt ist, aber dazu verwendet werden kann, darf zur Einfuhr ohne Untersuchung zugelassen werden, nachdem es zum Genusse für Menschen unbrauchbar gemacht ist.

§. 18.

Bei Pferden muss die Untersuchung (§. 1) durch approbirte Thierärzte vorgenommen werden.

Der Vertrieb von Pferdefleisch sowie die Einfuhr solchen Fleisches in das Zollinland darf nur unter einer Bezeichnung erfolgen, welche in deutscher Sprache das Fleisch als Pferdefleisch erkennbar macht.

Fleischhändlern, Gast-, Schank- und Speisewirthen ist der Vertrieb und die Vertrieb und die Verwendung von Pferdefleisch nur mit Genehmigung der Polizeibehörde gestattet; die Genehmigung ist jederzeit widerruflich. An die vorbezeichneten Gewerbetreibenden darf Pferdefleisch nur abgegeben werden, soweit ihnen eine solche Genehmigung ertheilt worden ist. In den Geschäftsräumen dieser Personen muss an einer in die Augen fallenden Stelle durch deutlichen Anschlag besonders erkennbar gemacht werden, dass Pferdefleisch zum Vertrieb oder zur Verwendung kommt.

Fleischhändler dürfen Pferdefleisch nicht in Räumen feilhalten oder verkaufen, in welchen Fleisch von anderen Thieren feilgehalten oder verkauft wird.

Der Bundesrath ist ermächtigt, anzuordnen, dass die vorstehenden Vorschriften auf Esel, Maulesel, Hunde und sonstige, seltener zur Schlachtung gelangende Thiere entsprechende Anwendung finden.

§. 19.

Der Beschauer hat das Ergebniss der Untersuchung an dem Fleische kenntlich zu machen. Das aus dem Auslande eingeführte Fleisch ist ausserdem als solches kenntlich zu machen.

Der Bundesrath bestimmt die Art der Kennzeichnung.

§. 20.

Fleisch, welches innerhalb des Reichs der amtlichen Untersuchung nach Massgabe der §§. 8 bis 16 unterlegen hat, darf einer abermaligen amtlichen Untersuchung nur zu dem Zwecke unterworfen werden, um festzustellen, ob das Fleisch inzwischen verdorben ist oder sonst eine gesundheitsschädliche Veränderung seiner Beschaffenheit erlitten hat.

Landesrechtliche Vorschriften, nach denen für Gemeinden mit öffentlichen Schlachthäusern der Vertrieb frischen Fleisches Beschränkungen, insbesondere dem Beschauzwang innerhalb der Gemeinde unterworfen werden kann, bleiben mit der Massgabe unberührt, dass ihre Anwendbarkeit nicht von der Herkunft des Fleisches abhängig gemacht werden darf.

§. 21.

Bei der gewerbsmässigen Zubereitung von Fleisch dürfen Stoffe oder Arten des Verfahrens, welche der Waare eine gesundheitsschädliche Beschaffenheit zu verleihen vermögen, nicht angewendet werden. Es ist verboten, derartig zubereitetes Fleisch aus dem Ausland einzuführen, feilzuhalten, zu verkaufen oder sonst in Verkehr zu bringen.

Der Bundesrath bestimmt die Stoffe und die Arten des Verfahrens, auf welche diese Vorschriften Anwendung finden.

Der Bundesrath ordnet an, inwieweit die Vorschriften des Abs. 1 auch auf bestimmte Stoffe und Arten des Verfahrens Anwendung finden, welche eine gesundheitsschädliche oder minderwerthige Beschaffenheit der Waare zu verdecken geeignet sind.

§. 22.

Der Bundesrath ist ermächtigt,

1. Vorschriften über den Nachweis genügender Kenntnisse der Fleischbeschauer zu erlassen,
2. Grundsätze aufzustellen, nach welchen die Schlachtvieh- und Fleischbeschau auszuführen und die weitere Behandlung des Schlachtviehs und Fleisches im Falle der Beanstandung stattzufinden hat,
3. die zur Ausführung der Bestimmungen in dem §. 12 erforderlichen Anordnungen zu treffen und die Gebühren für die Untersuchung des in das Zollinland eingehenden Fleisches festzusetzen.

§. 23.

Wem die Kosten der amtlichen Untersuchung (§. 1) zur Last fallen, regelt sich nach Landesrecht. Im Uebrigen werden die zur Ausführung des Gesetzes erforderlichen Bestimmungen, insoweit nicht der Bundesrath für zuständig erklärt ist oder insoweit er von einer durch §. 22 ertheilten Ermächtigung keinen Gebrauch macht, von den Landesregierungen erlassen.

§. 24.

Landesrechtliche Vorschriften über die Trichinenschau und über den Vertrieb und die Verwendung von Fleisch, welches zwar zum Genusse für Menschen tauglich, jedoch in seinem Nahrungs- und Genusswerth erheblich herabgesetzt ist, ferner landesrechtliche Vorschriften, welche mit Bezug auf

1. die der Untersuchung zu funterwerfenden Thiere,
2. die Ausführung der Untersuchungen durch approbirte Thierärzte,
3. den Vertrieb beanstandeten Fleisches oder des Fleisches von Thieren der im §. 18 bezeichneten Arten

weitergehende Verpflichtungen als dieses Gesetz begründen, sind mit der Massgabe zulässig, dass ihre Anwendbarkeit nicht von der Herkunft des Schlachtviehs oder des Fleisches abhängig gemacht werden darf.

§. 25.

Inwieweit die Vorschriften dieses Gesetzes auf das in die Zollausschlüsse eingeführte Fleisch Anwendung zu finden haben, bestimmt der Bundesrath.

§. 26.

Mit Gefängniss bis zu sechs Monaten und mit Geldstrafe bis zu eintausendfünfhundert Mark oder mit einer dieser Strafen wird bestraft:

1. wer wissentlich den Vorschriften des §. 9 Abs. 2, 4, des §. 10 Abs. 2, 3, des §. 12 Abs. 1 oder des §. 21 Abs. 1, 2 oder einem auf Grund des §. 21 Abs. 3 ergangenen Verbote zuwiderhandelt;

2. wer wissentlich Fleisch, das den Vorschriften des §. 12 Abs. 1 zuwider eingeführt oder auf Grund des §. 17 zum Genusse für Menschen unbrauchbar gemacht worden ist, als Nahrungs- oder Genussmittel für Menschen in Verkehr bringt;
3. wer Kennzeichen der im §. 19 vorgesehenen Art fälschlich anbringt oder verfälscht, oder wer wissentlich Fleisch, an welchem die Kennzeichen fälschlich angebracht, verfälscht oder beseitigt worden sind, feilhält oder verkauft.

§. 27.

Mit Geldstrafe bis zu einhundertfünfzig Mark oder mit Haft wird bestraft:

1. wer eine der im §. 26 Nr. 1 und 2 bezeichneten Handlungen aus Fahrlässigkeit begeht,
2. wer eine Schlachtung vornimmt, bevor das Thier der in diesem Gesetze vorgeschriebenen oder einer auf Grund des §. 1 Abs. 1 Satz 2, des §. 3, des §. 18 Abs. 5 oder des §. 24 angeordneten Untersuchung unterworfen worden ist,
3. wer Fleisch in Verkehr bringt, bevor es der in diesem Gesetze vorgeschriebenen oder einer auf Grund des §. 1 Abs. 1 Satz 2, des §. 3, des §. 14 Abs. 1, des §. 18 Abs. 5 oder des §. 24 angeordneten Untersuchung unterworfen worden ist,
4. wer den Vorschriften des §. 2 Abs. 2, des §. 7 Abs. 2, 3, des §. 8 Abs. 2, des §. 11, des §. 12 Abs. 2, des §. 13 Abs. 2 oder des §. 18 Abs. 2 bis 4, ingleichen wer den auf Grund des §. 15 oder des §. 18 Abs. 5 erlassenen Anordnungen oder den auf Grund des §. 24 ergehenden landesrechtlichen Vorschriften über den Vertrieb und die Verwendung von Fleisch zuwiderhandelt.

§. 28.

In den Fällen des §. 26 Nr. 1 und 2 und des §. 27 Nr. 1 ist neben der Strafe auf die Einziehung des Fleisches zu erkennen. In den Fällen des §. 26 Nr. 3 und des §. 27 Nr. 2 bis 4 kann neben der Strafe auf die Einziehung des Fleisches oder des Thieres erkannt werden. Für die Einziehung ist es ohne Bedeutung, ob der Gegenstand dem Verurtheilten gehört oder nicht.

Ist die Verfolgung oder Verurtheilung einer bestimmten Person nicht ausführbar, so kann auf die Einziehung selbstständig erkannt werden.

§. 29.

Die Vorschriften des Gesetzes, betreffend den Verkehr mit Nahrungsmitteln Genussmitteln und Gebrauchsgegenständen, vom 14. Mai 1879 (Reichs-Gesetzbl., S. 145) bleiben unberührt. Die Vorschriften des §. 16 des bezeichneten Gesetzes finden auch auf Zuwiderhandlungen gegen die Vorschriften des gegenwärtigen Gesetzes Anwendung.

§. 30.

Diejenigen Vorschriften dieses Gesetzes, welche sich auf die Herstellung der zur Durchführung der Schlachtvieh und Fleischbeschau erforderlichen Einrichtungen beziehen, treten mit dem Tage der Verkündigung dieses Gesetzes in Kraft.

Im Uebrigen wird der Zeitpunkt, mit welchem das Gesetz ganz oder theilweise in Kraft tritt, durch kaiserliche Verordnung mit Zustimmung des Bundesraths bestimmt.

Urkundlich unter Unserer Höchsteigenhändigen Unterschrift und bei gedrucktem kaiserlichen Insiegel.

Gegeben, &c.

Neues Palais, den 3. Juni 1900.

[L. S.] (Signed) WILHELM.
(Signed) FÜRST ZU HOHENLOHE.

IMPORTS AND EXPORTS OF ANIMALS AND ANIMAL PRODUCTS.

By GEORGE FAYETTE THOMPSON,
Editorial Clerk, Bureau of Animal Industry.

The Bureau of Statistics of the Treasury Department reports that the total value of exports of all kinds for the year 1900 was $1,477,949,666, an increase over 1899 of the large sum of $202,481,695. The increase of 1899 over 1898 was only about $20,000,000.

The total value of animals and animal products exported in 1900 was $271,826,854, being an increase over 1899 of $15,541,367. This showing is not quite so gratifying as that of 1899 over 1898, when there was an increase of $18,333,360. The table given below shows the total value of exports of animals and animal products and the gain or loss over the previous year for the years 1892 to 1900, inclusive:

Value of exports of animals and animal products, 1892–1900.

Year.	Value of exports.	Gain (+) or loss (−).
1892	$224,531,279	....
1893	196,243,366	−$28,288,913
1894	215,462,956	+19,219,590
1895	219,492,191	+4,029,135
1896	217,048,412	−2,443,779
1897	214,400,463	−2,647,949
1898	237,952,127	+23,551,664
1899	256,285,487	+18,332,350
1900	271,826,854	+15,541,367

These figures include, besides animals and meat and dairy products, leather, boots and shoes, harness and saddles, bones, hoofs, horns, candles, eggs, feathers, glue, grease and grease scraps, hair and hair manufactures, lard oil, and wool, both raw and manufactured.

Hides and skins other than furs were exported in 1900 to the value of $1,051,435, an increase over the previous year of $281,508.

Exports of leather and leather manufactures in 1900 were valued at $27,169,014, an increase during the year of $359,181, being but a small gain.

The following figures speak for the value of the exports in 1900 of meats and meat products: Canned beef, $5,150,013, an increase of $620,463 over 1899; fresh beef, $29,307,778, an increase of $1,113,081; tallow, $4,674,801, an increase of $161,250 only; bacon, $37,099,980, showing a loss of trade over 1899 of $4,908,939; hams, $21,043,597, a very small gain; pork, $11,368,181, an increase of $1,036,561; lard, $42,033,597, an increase of $480,455; oleomargarine, $11,985,976, a small increase; butter, $2,396,662, a heavy loss of $2,206,682; cheese, $5,549,254, a large increase of $2,173,146; milk, $1,288,127, an increase of about $100,000; wool and wool manufactures, $1,429,733, an increase of about $200,000.

The following table shows the value of the imports of animals and animal products for the four years 1897 to 1900, inclusive:

Table showing the value of imports of animals and animal products for the years 1897–1900.

[Compiled from reports of the Bureau of Statistics, Treasury Department.]

Articles imported.	1897.	1898.	1899.	1900.
Horses	$505,838	$521,835	$581,928	$886,811
Cattle	3,581,643	2,730,882	2,235,373	1,871,546
Sheep	1,145,922	1,187,210	1,305,063	1,260,182
All other, including fowls	212,078	242,080	282,383	138,649
Bones, hoofs, horns, etc	252,864	784,360	988,502	1,031,725
Bristles	1,308,932	1,245,591	1,871,010	1,995,289
Eggs	9,259	6,531	24,628	7,862
Feathers, etc	5,594,143	4,649,479	4,719,756	1,461,398
Glue	172,255	445,019	528,765	491,190
Grease and oils	834,416	380,665	575,668	475,815
Grease	47,389	243,742	245,710	198,136
Hair	2,383,709	1,829,112	2,477,332	2,065,002
Hides and skins	33,230,749	39,906,373	51,127,659	51,590,433
Hide cuttings and glue stock	....	290,500	1,068,273	1,186,627
Leather and leather manufactures	13,163,302	11,346,815	11,894,318	13,298,937
Meat and meat extracts	628,798	175,580	390,949	390,175
All other meat products	50,358	110,031	114,603	62,494
Dairy products	2,232,382	1,807,065	2,271,764	2,010,164
Sausage casings	194,191	560,943	622,544	738,529
Wool and wool manufactures	93,863,761	26,794,324	26,256,772	35,016,152
Total	159,411,989	95,258,137	109,583,000	116,176,976

The total value of the imports of 1900 was $116,176,976, being an increase over 1899 of $6,573,976. The increase last year over 1898 was $14,324,863.

The principal articles of this large value of imports are hides and skins, with $51,590,433; leather and leather manufactures, with $13,298,937, and wool and wool manufactures, with $35,016,152.

Among the hides and skins imported were 69,121,666 pounds of goatskins, valued at $19,009,537, being 27.5 cents per pound. In addition to these, morocco skins were imported to the value of $2,940,949.

The sum of $18,316,739 was paid for the hides of cattle imported, this being an increase of nearly $2,000,000 over 1899.

Next to hides and skins, the largest item of importation was wool and wool manufactures, the total value of which was $35,016,152.

This was an increase over 1899 of $8,759,380. Of the total sum, $19,210,062 were paid for raw wool and $15,806,090 for wool manufactures.

The total value of animals, including fowls, which were exported in 1900 was $49,153,012, a gain of $9,443,264 over 1899. Of this gain, $3,133,703 must be credited to cattle, $3,354,964 to horses, $3,055,793 to mules, and $39,397 to sheep. There was a small decrease in the value of the hogs exported.

The accompanying table shows the number and value of live animals exported and the countries to which they were exported:

Number and value of exports of farm animals for the year 1900 and countries to which exported.

[Compiled from reports of the Bureau of Statistics, Treasury Department.]

Country to which exported.	Number.	Value.
Cattle:		*Dollars.*
United Kingdom	335,020	31,414,083
Other Europe	391	34,270
British North America	9,043	508,559
Central American States and British Honduras	13	1,668
Mexico	3,201	140,119
West Indies and Bermuda	74,595	1,657,216
South America	871	60,444
Asia and Oceania	47	2,805
Other countries	....	....
Total	423,181	33,819,164
Hogs:		
United Kingdom	....	....
British North America	1,668	14,853
Mexico	2,095	24,534
West Indies and Bermuda	28,633	264,416
South America	7	150
Asia and Oceania	1,480	9,415
Other countries	32	468
Total	33,915	313,836
Horses:		
United Kingdom	28,962	4,362,552
France	10	17,575
Germany	2,637	410,215
Other Europe	2,334	234,650
British North America	9,571	875,009
Central American States and British Honduras	74	10,750
Mexico	994	96,780
West Indies and Bermuda	5,089	307,449
South America	12	2,225
Hawaii[a]	264	29,790
Philippine Islands	2,471	189,610

[a] The commerce between the United States and Hawaii and Porto Rico, respectively, is not included in the statements of the foreign trade of the United States after June 30, 1900, but the trade of Hawaii with foreign countries is included in the statement of the commerce of the United States after that date. The commerce of Porto Rico is shown separately.

Number and value of exports of farm animals for the year 1900 and countries to which exported—Continued.

Countries to which exported.	Number.	Value.
Horses—Continued.		*Dollars.*
Other Asia and Oceania	3,860	349,900
Africa	23,242	2,215,927
Total	79,520	9,102,432
Mules	50,179	4,757,892
Sheep:		
United Kingdom	96,672	729,710
Other Europe	....	....
British North America	42,577	98,370
Mexico	3,509	13,503
West Indies and Bermuda	4,407	35,124
South America	1,059	10,531
Other countries	167	13,496
Total	148,391	900,734
All other, including fowls	....	256,954

For convenience in comparing imports and exports of live animals, a table has been prepared which gives statistics for the five years 1896 to 1900, inclusive, and is as follows:

Number and value of imports and exports of farm animals for the years 1896 to 1900.

[Compiled from reports of the Bureau of Statistics, Treasury Department.]

Year.	Cattle.		Hogs.		Horses.		Mules.		Sheep.	
	Number.	Value.	Number.	Value.	Number.	Value.	Number.	Value.	Number.	Value.
EXPORTS.		*Dollars.*		*Dollars.*		*Dollars.*		*Dollars.*		*Dollars.*
1896	394,772	36,576,412	33,785	367,917	28,632	3,601,137	6,534	475,106	323,576	1,948,841
1897	447,469	39,379,532	16,841	150,814	45,642	5,617,265	7,753	631,904	218,427	1,331,712
1898	397,879	33,463,267	16,879	117,546	48,917	6,010,773	6,996	514,569	176,498	1,070,966
1899	409,176	30,685,461	52,230	363,609	49,983	5,747,468	20,228	1,702,099	150,824	861,337
1900	423,181	33,819,164	33,915	613,836	79,520	9,102,432	50,179	4,757,892	148,391	900,734
IMPORTS.										
1896	141,653	988,677	......	....	8,252	509,819	......	....	382,443	1,013,481
1897	403,717	3,581,643	......	....	5,993	505,838	......	....	414,455	1,145,922
1898	261,826	2,730,882	......	....	2,718	321,835	......	....	360,820	1,187,210
1899	186,596	2,235,383	......	....	3,215	581,928	......	....	351,731	1,305,063
1900	142,055	1,871,546	......	....	3,541	886,811	......	....	345,985	1,260,132

EXPORTS TO THE UNITED KINGDOM.

Interest always attaches to the United Kingdom as an importer of our products. She purchased this class of goods from us in 1899 to the value of $155,335,299, while in 1900 the value arose to $163,821,666, this being an increase of $8,486,367 over 1899. The gain of 1899 over 1898 was $6,295,516.

It should be stated that these amounts do not give the exact exports, as with several items the exports are not given by countries of import. The accompanying table shows the items considered, and it also includes the figures for 1899 in order that comparisons may be made:

Quantity and value of animals and animal products purchased by the United Kingdom from the United States in the years 1899 and 1900.

[Compiled from reports of the Bureau of Statistics, Treasury Department.]

Article.	1899.		1900.	
	Quantity.	Value.	Quantity.	Value.
	Number.	*Dollars.*	*Number.*	*Dollars.*
Cattle	303,539	27,737,770	335,020	31,414,083
Hogs	24	180	....	....
Horses	24,288	3,172,798	28,962	4,362,552
Sheep	95,399	692,727	96,672	729,710
	Pounds.		*Pounds.*	
Hides and skins (other than furs)	284,393	31,564	153,754	16,092
Sole leather	32,089,378	5,398,991	26,924,895	4,960,378
Upper leather	....	10,802,144	....	9,533,691
Boots and shoes	....	710,131	....	1,094,672
Canned beef	28,454,654	2,604,291	34,123,691	3,326,442
Fresh beef	319,834,656	27,950,180	322,860,648	28,943,559
Other beef	19,324,965	1,185,936	21,047,769	1,277,138
Tallow	39,822,556	1,760,373	40,535,458	2,026,362
Bacon	401,158,150	30,589,831	376,137,577	30,275,054
Hams	178,322,522	17,455,779	170,559,938	18,242,651
Pork	89,465,150	5,817,416	85,470,352	6,241,112
Lard	217,172,843	13,264,493	205,491,297	14,244,979
Oleo oil and oleomargarine	7,305,941	494,077	10,002,294	737,144
Butter	17,001,068	2,869,580	6,092,512	1,311,588
Cheese	29,272,702	2,797,035	49,924,492	5,084,459
Total	....	155,335,299	....	163,821,666

The value of the cattle shipped to the United Kingdom was increased from $27,737,770, which was the amount in 1899, to $31,414,083 in 1900, but even then did not quite reach the total of 1898, when it was $31,668,909. The value of the exports of horses and sheep also increased to some extent. There was a decrease in leather, but an increase in boots and shoes, and also for all meat products. Oleo and oleomargarine showed a gain of $243,067, and cheese $2,297,424, but butter showed a heavy loss of $1,557,992 during the year 1900.

EXPORTS TO GERMANY.

Our total exports to Germany decreased in 1899 to the extent of over $3,000,000, and a further decrease in 1900 of $1,930,121 is shown. The value of the goods Germany received from us in 1900 was $19,889,894.

The accompanying table shows, in detail, the products taken. The largest item of export to the Empire was lard, the value of which was $11,813,139 and the quantity 174,449,072 pounds. It also takes

30,541,719 pounds of oleo and oleomargarine, valued at $2,378,330; and 19,946,653 pounds of bacon, valued at $1,513,383.

Quantity and value of animals and animal products purchased by Germany from the United States in 1899 and 1900.

[Compiled from reports of the Bureau of Statistics, Treasury Department.]

Article.	1899.		1900.	
	Quantity.	Value.	Quantity.	Value.
	Pounds.	*Dollars.*	*Pounds.*	*Dollars.*
Horses ....number..	4,348	682,880	2,667	410,215
Hides and skins (other than furs)	8,888,000	339,561	4,577,370	388,224
Sole leather..........	309,433	66,141	218,083	47,857
Upper leather..........	....	972,655	....	851,708
Boots and shoes..........	....	101,335	....	142,029
Canned beef	2,708,907	244,410	4,207,011	465,127
Other beef	4,946,814	262,843	6,953,010	404,293
Tallow	11,565,329	521,174	18,240,782	658,900
Bacon..........	33,289,598	2,339,825	19,946,653	1,513,383
Hams	6,570,591	620,167	2,435,065	230,255
Pork	16,473,445	900,796	10,388,611	628,035
Lard	207,764,222	12,509,371	174,449,072	11,813,139
Oleo and oleomargarine	27,928,997	2,121,601	30,541,719	2,378,330
Butter	872,921	137,546	109,353	18,390
Cheese	1,864	210	64	14
Total..........	....	21,820,015	....	19,889,894

EXPORTS TO FRANCE.

The value of our exports to France show a decrease of about $1,000,000—just about the amount of the gain of 1899 over 1898. The principal item of France's import from us is lard, the value of which in 1900 was $1,461,487. The accompanying table shows the exports, by items, for the years 1899 and 1900:

Quantity and value of animals and animal products purchased by France from the United States in 1899 and 1900.

[Compiled from reports of the Bureau of Statistics, Treasury Department.]

Article.	1899.		1900.	
	Quantity.	Value.	Quantity.	Value.
	Pounds.	*Dollars.*	*Pounds.*	*Dollars.*
Horses ....number..	687	99,330	10	17,575
Hides and skins (other than furs)	105,168	18,719	94,140	13,976
Leather	....	484,729	....	472,826
Boots and shoes..........	....	101,335	....	82,446
Canned beef	673,577	60,696	1,175,776	118,842
Other beef	173,200	9,545	559,100	31,913
Tallow	14,009,982	580,194	11,207,072	557,945
Bacon..........	14,353,473	958,730	7,464,961	494,068
Hams	1,237,167	113,583	1,754,585	174,118
Pork	165,391	9,746	111,725	6,771
Lard	35,003,185	2,002,760	21,660,779	1,461,487
Total..........	....	4,439,367	....	3,431,965

IMPORTS AND EXPORTS OF EGGS.

The gratifying feature of the egg trade, as shown in the accompanying table, is the increase in our exports and the decrease in the imports. For purposes of comparison the figures for the years 1892 to 1900, inclusive, are given. It will be observed that our exports of eggs were valued at $34,851 only in 1892, but in 1900 had reached the excellent amount of $1,000,139.

Imports and exports of eggs from 1892 to 1900.

Year.	Imports.		Exports.	
	Quantity.	Value.	Quantity.	Value.
	Dozens.	*Dollars.*	*Dozens.*	*Dollars.*
1892	3,373,086	379,516	193,742	34,851
1893	2,457,576	284,178	151,311	43,098
1894	1,641,901	190,437	174,523	28,258
1895	1,954,962	219,459	181,754	29,346
1896	677,359	56,004	405,192	63,460
1897	190,674	9,259	2,734,218	424,819
1898	129,711	6,531	2,356,474	394,982
1899	259,106	24,628	4,595,994	816,855
1900	117,596	7,862	5,937,032	1,000,139

MEAT AND MEAT PRODUCTS AND DAIRY PRODUCTS.

A tabular statement is given below of the exports of meat and meat products and dairy products for the years 1896 to 1900, inclusive. It will no doubt prove interesting to anyone who may desire to study the increase or decrease of exports of any or all of the articles mentioned:

Exports of meat and meat products and dairy products for the years 1896 to 1900.

[Compiled from reports of the Bureau of Statistics, Treasury Department.]

Article.	Quantity.	Value.	Article.	Quantity.	Value.
Canned beef:	*Pounds.*	*Dollars.*	Tallow:	*Pounds.*	*Dollars.*
1896	61,168,927	5,335,283	1896	85,449,086	3,336,111
1897	42,804,831	3,728,607	1897	55,609,096	2,029,735
1898	27,866,632	3,448,240	1898	106,819,190	4,209,395
1899	49,393,218	4,529,550	1899	97,213,186	4,283,751
1900	51,915,745	5,150,013	1900	92,555,436	4,674,801
Fresh beef:			Bacon:		
1896	282,925,463	22,498,251	1896	436,859,660	31,057,506
1897	279,882,590	22,298,328	1897	578,082,822	39,820,382
1898	267,458,906	22,644,040	1898	619,683,235	45,786,045
1899	322,635,630	28,194,697	1899	558,005,388	41,008,919
1900	326,356,576	29,307,778	1900	469,924,828	37,099,980
Other cured beef:			Hams:		
1896	85,893,296	4,707,094	1896	156,912,852	15,224,842
1897	43,854,117	2,244,568	1897	171,956,663	16,581,659
1898	48,724,793	2,737,304	1898	220,011,750	20,384,650
1899	46,065,647	2,617,828	1899	216,646,559	21,015,536
1900	56,351,147	3,277,080	1900	198,328,048	21,043,537

Exports of meat and meat products and dairy products for the years 1896 to 1900—**Cont'd.**

Article.	Quantity.	Value.
Pork:	*Pounds.*	*Dollars.*
1896	63, 859, 513	3, 223, 147
1897	72, 949, 589	3, 853, 182
1898	147, 231, 864	8, 827, 365
1899	171, 615, 148	10, 331, 620
1900	166, 491, 822	11, 368, 181
Lard:		
1896	526, 320, 203	29, 821, 308
1897	630, 060, 611	32, 622, 409
1898	736, 636, 222	43, 440, 170
1899	690, 068, 669	41, 531, 142
1900	609, 473, 372	42, 033, 597
Oleo oil and oleomargarine:		
1896	120, 686, 267	8, 255, 849
1897	122, 055, 911	7, 391, 091
1898	142, 272, 339	8, 654, 721
1899	144, 438, 709	10, 241, 347
1900	164, 322, 339	11, 985, 976
Butter:		
1896	27, 220, 213	3, 909, 900
1897	30, 914, 783	4, 497, 878
1898	15, 034, 189	2, 428, 143
1899	27, 309, 869	4, 502, 744
1900	13, 283, 557	2, 396, 062
Cheese:		
1896	44, 530, 234	3, 846, 703
1897	60, 180, 651	5, 432, 371
1898	40, 523, 994	3, 376, 818
1899	34, 686, 833	3, 376, 108
1900	54, 059, 049	5, 549, 254
Canned pork:	*Pounds.*	*Dollars.*
1899 *a*	3, 570, 524	270, 577
1900	9, 368, 005	744, 197
Poultry and game:		
1896		51, 981
1897		66, 316
1898		91, 819
1899		236, 322
1900		679, 440
Sausage and sausage meats:		
1900 *a*	5, 867, 982	543, 804
Sausage casings:		
1896		1, 686, 930
1897		1, 677, 033
1898		1, 762, 431
1899		1, 899, 154
1900		2, 931, [illegible]
Meat products not specified:		
1896		2, 413, 281
1897		3, 243, 188
1898		5, 190, 547
1899		5, 810, 955
1900		5, 015, 000
Milk:		
1896		397, 181
1897		635, 370
1898		692, 925
1899		1, 188, 057
1900		1, 288, 127

a Included in "All other meat products" previous to July, 1899.

The following table gives the quantity and value of the exports of meat and meat products and dairy products for the year 1900 and also the countries to which exported:

Quantity and value of exports of meat and meat products and dairy products for the year 1900.

[Compiled from reports of the Bureau of Statistics, Treasury Department.]

Country to which exported.	Quantity.	Value.
Canned beef:	*Pounds.*	*Dollars.*
United Kingdom	34, 123, 691	3, 326, 442
France	1, 175, 776	118, 842
Germany	4, 207, 011	405, 127
Other Europe	2, 361, 442	224, 193
British North America	670, 720	62, 625
Central American States and British Honduras	236, 677	26, 642
Mexico	172, 868	22, 094
Santo Domingo	788	84

Quantity and value of exports of meat and meat products and dairy products for the year 1900—Continued.

Country to which exported.	Quantity.	Value.
Canned beef—Continued.	*Pounds.*	*Dollars.*
Cuba	61,174	6,185
Porto Rico [a]	2,420	213
Other West Indies and Bermuda	232,911	25,659
Argentina	13,424	1,045
Brazil	196,200	22,184
Colombia	70,926	7,604
Other South America	194,647	21,527
Chinese Empire	708,408	101,504
British East Indies	43,070	5,306
Hongkong	440,920	65,770
Japan	957,173	138,874
British Australasia	127,871	14,276
Hawaii [a]	401,400	60,003
Philippine Islands	32,512	4,569
Other Asia and Oceania	147,722	19,759
Africa	5,333,810	469,238
Other countries	2,184	218
Total	51,915,745	5,150,013
Fresh beef:		
United Kingdom	322,860,648	28,943,559
British North America	109,781	10,649
West Indies and Bermuda	3,115,894	332,628
Hawaii	268,804	20,782
Other countries	1,449	160
Total	326,356,576	29,307,778
Beef, other cured:		
United Kingdom	21,047,769	1,277,138
France	559,100	31,913
Germany	6,953,010	404,293
Other Europe	6,342,753	351,931
British North America	5,526,914	284,242
Central American States and British Honduras	714,555	39,892
Mexico	19,614	1,573
Santo Domingo	81,853	4,919
Cuba	251,359	14,464
Porto Rico [a]	16,000	912
Other West Indies and Bermuda	5,776,112	321,862
Brazil	19,050	1,356
Colombia	396,825	22,932
Other South America	3,547,828	214,350
Asia and Oceania	4,136,385	250,024
Africa	928,720	54,031
Other countries	33,300	1,848
Total	56,351,147	3,277,680
Tallow:		
United Kingdom	40,535,458	2,026,362
France	11,207,072	557,945

[a] The commerce between the United States and Hawaii and Porto Rico, respectively, is not included in the statements of the foreign trade of the United States after June 30, 1900, but the trade of Hawaii with foreign countries is included in the statement of the commerce of the United States after that date. The commerce of Porto Rico is shown separately.

Quantity and value of exports of meat and meat products and dairy products for the year 1900—Continued.

Country to which exported.	Quantity.	Value.
Tallow—Continued.	*Pounds.*	*Dollars.*
Germany	13,240,782	658,900
Other Europe	20,620,810	1,040,002
British North America	75,142	3,201
Central American States and British Honduras	2,092,770	115,799
Mexico	448,539	25,771
Santo Domingo	247,188	12,197
Cuba	77,740	3,920
Porto Rico[a]	1,470	84
Other West Indies and Bermuda	990,938	54,191
Brazil	932,897	61,436
Colombia	81,630	5,417
Other South America	1,924,505	105,637
Asia and Oceania	28,466	1,324
Other countries	50,529	2,615
Total	92,555,436	4,674,801
Bacon:		
United Kingdom	376,137,577	30,275,064
France	7,464,961	494,066
Germany	19,946,653	1,513,383
Other Europe	51,462,219	3,606,235
British North America	2,203,730	299,177
Central American States and British Honduras	831,799	29,735
Mexico	276,777	26,247
Santo Domingo	30,402	2,455
Cuba	7,305,306	541,610
Porto Rico[a]	577,226	40,039
Other West Indies and Bermuda	387,572	38,019
Brazil	1,825,633	137,842
Colombia	21,244	2,305
Other South America	300,317	25,239
Chinese Empire	173,472	23,339
Hawaii[a]	76,340	9,586
Philippine Islands	4,336	570
Other Asia and Oceania	86,270	11,627
Africa	812,994	23,452
Total	469,924,828	37,099,990
Hams:		
United Kingdom	170,559,938	18,242,651
France	1,754,585	174,118
Germany	2,435,065	230,255
Other Europe	9,913,720	978,773
British North America	2,426,191	268,956
Central American States and British Honduras	297,524	31,904
Mexico	374,147	43,852
Santo Domingo	100,413	12,620
Cuba	6,548,036	633,096
Porto Rico[a]	196,784	18,275
Other West Indies and Bermuda	1,666,988	168,019

[a] The commerce between the United States and Hawaii and Porto Rico, respectively, is not included in the statements of the foreign trade of the United States after June 30, 1900, but the trade of Hawaii with foreign countries is included in the statement of the commerce of the United States after that date. The commerce of Porto Rico is shown separately

Quantity and value of exports of meat and meat products and dairy products for the year 1900—Continued.

Country to which exported.	Quantity.	Value.
	Pounds.	*Dollars.*
Hams—Continued.		
Brazil	47,560	5,509
Colombia	215,595	20,651
Other South America	642,625	76,561
Chinese Empire	257,779	33,739
British Australasia	118,936	11,374
Hawaii [a]	223,419	27,724
Philippine Islands	78,926	10,200
Other Asia and Oceania	247,888	32,422
Africa	199,017	20,571
Other countries	22,912	2,263
Total	198,328,048	21,043,537
Pork, canned	9,368,005	744,197
Pork, fresh and cured:		
United Kingdom	85,470,352	6,241,112
France	111,725	6,771
Germany	10,338,611	628,035
Other Europe	26,611,985	1,734,798
British North America	9,400,961	574,834
Central American States and British Honduras	1,643,205	105,777
Santo Domingo	145,290	10,024
Cuba	7,995,376	561,756
Porto Rico [a]	2,324,200	134,391
Other West Indies and Bermuda	17,242,110	1,033,571
Brazil	23,150	1,527
Colombia	282,418	20,099
Other South America	4,299,937	273,412
Philippine Islands	800	56
Other Asia and Oceania	143,130	11,445
Africa	188,700	12,524
Other countries	269,872	18,049
Total	166,491,822	11,368,181
Lard:		
United Kingdom	205,491,297	14,244,979
France	21,660,779	1,461,487
Germany	174,449,072	11,813,139
Other Europe	116,753,552	7,922,635
British North America	1,666,959	121,910
Central American States and British Honduras	2,941,478	220,917
Mexico	6,951,874	446,237
Santo Domingo	564,268	42,285
Cuba	38,938,317	2,684,191
Porto Rico [a]	3,812,468	236,253
Other West Indies and Bermuda	6,581,743	505,503
Argentina	89,198	7,279
Brazil	9,993,913	847,603
Colombia	1,723,939	129,701
Other South America	12,579,884	965,390
Hawaii [a]	420,973	32,161

[a] The commerce between the United States and Hawaii and Porto Rico, respectively, is not included in the statements of the foreign trade of the United States after June 30, 1900, but the trade of Hawaii with foreign countries is included in the statement of the commerce of the United States after that date. The commerce of Porto Rico is shown separately.

Quantity and value of exports of meat and meat products and dairy products for the year 1900—Continued.

Country to which exported.	Quantity.	Value.
Lard—Continued.	*Pounds.*	*Dollars.*
Philippine Islands	126,458	10,847
Other Asia and Oceania	1,951,059	135,302
Africa	2,699,096	200,267
Other countries	77,015	5,451
Total	609,473,372	42,083,597
Lard compounds, and substitutes for (cottolene, lardine, etc.)	23,145,737	1,426,430
Mutton	735,675	53,215
Oleo and oleomargarine:		
United Kingdom	10,002,294	737,144
Germany	30,541,719	2,378,830
Netherlands	89,797,202	6,246,014
Other Europe	29,522,604	2,197,237
British North America	1,062,495	76,755
Central American States and British Honduras	130,871	13,647
Mexico	5,476	746
Porto Rico *a*	103,400	10,568
Other West Indies and Bermuda	2,381,618	246,547
Colombia	129,164	11,507
Other South America	249,145	27,085
Hawaii *a*	79,400	8,517
Philippine Islands	100	13
Other Asia and Oceania	126,431	13,296
Other countries	190,360	18,550
Total	164,322,339	11,985,976
Poultry and game	....	679,410
Sausage and sausage meats	5,867,982	543,804
Sausage casings	....	2,931,603
All other meat products:		
Canned	....	1,659,021
All other	....	3,355,979
Butter:		
United Kingdom	6,092,512	1,311,568
Germany	109,353	18,390
Other Europe	174,208	25,742
British North America	852,194	189,354
Central American States and British Honduras	239,481	49,037
Mexico	246,352	45,754
Santo Domingo	157,485	26,069
Cuba	160,676	29,408
Porto Rico *a*	21,387	4,132
Other West Indies and Bermuda	2,773,607	310,387
Brazil	1,454,323	201,237
Columbia	68,669	14,354
Other South America	671,079	112,744
Chinese Empire	22,770	6,956

a The commerce between the United States and Hawaii and Porto Rico, respectively, is not included in the statements of the foreign trade of the United States after June 30, 1900, but the trade of Hawaii with foreign countries is included in the statement of the commerce of the United States after that date. The commerce of Porto Rico is shown separately.

Quantity and value of exports of meat and meat products and dairy products for the year 1900—Continued.

Country to which exported.	Quantity.	Value.
Butter—Continued.	*Pounds.*	*Dollars.*
Japan	75,004	15,211
Hawaii [a]	115,921	26,737
Philippine Islands	1,530	467
Other Asia and Oceania	17,369	3,918
Africa	7,683	1,801
Other countries	14,954	2,826
Total	13,283,557	2,396,062
Cheese:		
United Kingdom	49,924,492	5,084,459
Germany	64	14
British North America	1,951,457	195,073
Central American States and British Honduras	187,888	24,181
Mexico	224,920	25,918
Santo Domingo	63,433	8,265
Cuba	257,819	33,465
Porto Rico [a]	242,180	28,538
Other West Indies and Bermuda	575,912	75,110
Brazil	487	64
Colombia	55,811	7,614
Other South America	50,516	6,857
Chinese Empire	180,410	19,664
Japan	55,755	6,553
Hawaii [a]	87,730	9,945
Philippine Islands	23,699	2,930
Other Asia and Oceania	159,259	18,469
Other countries	17,217	2,135
Total	54,059,049	5,549,254
Milk	....	1,288,127

[a] The commerce between the United States and Hawaii and Porto Rico, respectively, is not included in the statements of the foreign trade of the United States after June 30, 1900, but the trade of Hawaii with foreign countries is included in the statement of the commerce of the United States after that date. The commerce of Porto Rico is shown separately.

WOOL AND WOOL MANUFACTURES.

The total value of the wool and wool manufactures imported in 1900 was $35,016,152, being an increase of $8,759,380 over the previous year. In the matter of the value of clothing wool there was a large increase, from $2,803,680 in 1899 to $8,498,228, in 1900. A large increase is also shown for combing and carpet wools.

In manufactured goods the value of imports showed but small increase.

The accompanying table gives for 1900 the imports and exports of wool and the countries from which the wool and wool manufactures were received:

Quantity and value of imports and exports of wool and wool manufactures (including hair of goat, camel, etc.) for 1900.

[Compiled from reports of the Bureau of Statistics, Treasury Department.]

IMPORTS.

Country of import or export.	Quantity.	Value.
CLASS 1.—*Clothing wool.*	*Pounds.*	*Dollars.*
United Kingdom	15,005,333	3,036,343
France	73,039	10,887
South America	12,047,269	2,272,565
Asia and Oceania	10,970,583	2,951,830
Other countries	991,425	226,603
Total	39,087,649	8,498,228
CLASS 2.—*Combing wool.*		
United Kingdom	8,321,964	1,631,981
Other Europe	471,697	163,841
British North America	1,645,537	345,065
South America	224,104	52,607
Asia and Oceania	25,840	7,102
Other countries	250,241	34,500
Total	10,939,403	2,235,096
CLASS 3.—*Carpet wool.*		
United Kingdom	24,839,971	2,678,723
France	2,549,958	253,375
Germany	2,588,432	268,782
Other Europe	20,694,234	1,958,662
South America	10,895,086	905,711
Chinese Empire	18,614,614	1,373,341
Other Asia and Oceania	9,234,525	989,749
Other countries	464,846	48,395
Total	89,881,666	8,476,738
Carpets and carpeting:	*Square yards.*	
United Kingdom	266,930	607,652
Other Europe	470,779	1,634,349
Japan	1,173	1,256
Other Asia and Oceania	164,354	469,949
Other countries	13,384	44,813
Total	916,620	2,758,019
Cloth:	*Pounds.*	
United Kingdom	2,975,321	3,194,401
Austria-Hungary	64,625	60,193
Belgium	126,172	131,076
France	204,099	263,851
Germany	1,060,661	1,065,981
Other Europe	4,447	4,246
Other countries	11,359	11,108
Total	4,446,684	4,730,856

Quantity and value of imports and exports of wool and wool manufactures (including hair of goat, camel, etc.) for 1900—Continued.

IMPORTS—Continued.

Country of import or export.	Quantity.	Value.
Dress goods:	*Square yards.*	*Dollars.*
United Kingdom	12,635,240	2,258,448
France	7,884,641	1,189,517
Germany	4,769,347	1,833,788
Other Europe	156,565	32,835
Other countries	348	228
Total	25,446,141	4,764,816
Manufactures of wool	....	15,806,090

EXPORTS.

Articles.	Quantity.	Value.
		Dollars.
Raw wool ....pounds..	421,810	59,338
Manufactures:		
Carpets ....square yards..	151,019	121,589
Dress goods ....do....	16,435	9,416
Flannels and blankets	....	160,607
Wearing apparel	....	682,105
All other	....	456,066
Total	....	1,489,071

Value of imports of wool and wool manufactures for the years 1892 to 1900.

[Compiled from reports of the Bureau of Statistics, Treasury Department.]

Years.	Class 1 (clothing wool).	Class 2 (combing wool).	Class 3 (carpet wool).	Manufactures.	Total.
	Dollars.	*Dollars.*	*Dollars.*	*Dollars.*	*Dollars.*
1892	9,309,640	1,375,651	10,505,348	37,515,445	58,703,084
1893	5,373,238	895,266	7,485,045	30,238,506	43,992,055
1894	5,315,919	1,166,150	6,780,443	17,342,682	30,605,194
1895	19,657,912	4,092,656	10,019,591	60,319,331	94,089,490
1896	13,077,712	2,032,169	7,311,533	37,109,363	59,530,777
1897	33,953,828	6,946,102	12,532,300	29,330,284	82,762,514
1898	4,639,220	301,337	6,646,019	13,834,296	25,420,872
1899	2,803,680	1,499,276	7,356,688	14,596,847	26,256,491
1900	8,498,228	2,235,096	8,476,738	15,806,090	35,016,152

Exports of wool and wool manufactures for the years 1892 to 1900.

Year.	Raw wool.	Manufactures.	Total.
	Dollars.	*Dollars.*	*Dollars.*
1892	38,799	273,835	312,634
1893	36,139	559,379	595,518
1894	232,162	736,360	968,522
1895	689,874	782,855	1,472,729
1896	968,866	945,103	1,918,969
1897	144,608	1,058,956	1,203,564
1898	14,406	1,020,810	1,035,216
1899	566,295	1,229,539	1,795,834
1900	59,338	1,429,733	1,489,071

IMPORTS AND EXPORTS OF HIDES AND SKINS.

Our imports of hides and skins (other than furs) in 1900 was less than in 1899 by 11,003,707 pounds, but we paid $462,774 more for them. The accompanying table shows that in 1900 we imported 307,257,924 pounds of hides and skins, valued at $51,590,433, while in 1899 the amount was 318,261,631 pounds, valued at $51,127,659.

Quantity and value of imports and exports of hides and skins (other than furs) by the United States for the year 1900.

[Compiled from reports of the Bureau of Statistics, Treasury Department.]

Country of import or export.	Imports.		Exports.	
	Quantity.	Value.	Quantity.	Value.
	Pounds.	*Dollars.*	*Pounds.*	*Dollars.*
United Kingdom	37,166,466	6,233,629	153,744	16,092
France	19,969,804	4,145,719	91,140	13,976
Germany	20,889,410	3,371,762	4,577,370	388,224
Other Europe	46,229,584	6,834,683	252,984	40,040
British North America	15,999,137	1,416,273	5,508,822	584,271
Central American States	3,896,668	599,725	....	....
Mexico	13,137,851	2,393,478	11,196	2,103
West Indies and Bermuda	1,487,704	341,810	22,548	4,543
Japan	....	....	6,900	852
Other Asia and Oceania	20,084,791	4,108,719	5,635	1,203
Africa	5,020,421	997,295	....	....
South America	57,141,912	10,626,802	....	....
East Indies	66,212,792	10,518,967	....	....
Other countries	21,384	1,571	2,055	131
Total	307,257,924	51,590,433	10,635,394	1,051,435

The tabular statement below shows the imports and exports for the four years 1896 to 1900, inclusive:

Imports and exports of hides and skins for the years 1896 to 1900.

Year.	Imports.		Exports.	
	Quantity.	Value.	Quantity.	Value.
	Pounds.	*Dollars.*	*Pounds.*	*Dollars.*
1896	146,159,006	20,713,538	42,009,166	3,481,364
1897	236,372,088	33,230,749	18,778,031	1,553,622
1898	256,188,970	39,906,373	11,397,129	1,018,433
1899	318,261,631	51,127,659	7,514,483	769,927
1900	307,257,924	51,590,433	10,635,394	1,051,435

IMPORTS OF GOATSKINS AND GOATSKIN MANUFACTURES.

It is not generally realized by the public how limited is the domestic production of goatskins or how extensively goatskin manufactures are used in this country. Our own production of the raw skins is inconsiderable at this time.

The tabular statement given herewith shows the number and value of goatskins, the number and value of morocco skins (which are prepared goatskins), and the value of gloves which were imported from 1896 to 1900, inclusive. It is true that some of the gloves imported are not made of goat leather, but most of them are of that material. This statement does not contain a large number of first-class Angora goatskins, which, under the tariff act, come in as "fur skins."

The table, as a whole, will give a pretty accurate showing of the growth and present importance of the commerce in goatskins, and may lead our people to consider the practicability of utilizing some of our otherwise useless land for the production of goatskins.

Quantity and value of imports of goatskins, morocco skins, and gloves for the years 1896 to 1900.

[Compiled from reports of the Bureau of Statistics, Treasury Department.]

Article.	Quantity.	Value.
Goatskins:	*Pounds.*	*Dollars.*
1896	38,882,234	8,803,609
1897	59,177,556	13,802,504
1898	65,546,570	16,854,430
1899	80,064,583	20,992,949
1900	69,121,666	19,009,537
Morocco leather:		
1896	....	2,808,322
1897	....	3,748,341
1898	....	2,452,655
1899	....	2,831,035
1900	....	2,940,949
Gloves:[a]		
1896	....	5,618,311
1897	....	6,337,410
1898	....	5,683,167
1899	....	5,544,871
1900	....	6,434,291

[a] These gloves are imported from Belgium, France, and Germany, and from other Europe in smaller quantities.

LEATHER AND LEATHER MANUFACTURES.

Quantity and value of imports and exports of leather and leather manufactures for the year 1900.

[Compiled from reports of the Bureau of Statistics, Treasury Department.]

IMPORTS.

Country of import or export.	Quantity.	Value.
Leather:	*Pounds.*	*Dollars.*
Band or belting and sole leather		45,566
Calfskins, tanned, or tanned and dressed, and patent, enameled, and japanned		94,855
Skins for morocco		2,940,949
Upper leather, dressed, and skins, dressed and finished		3,115,400
Total		6,196,770
Manufactures:		
Gloves:		
Belgium		267,229
France		2,424,725
Germany		2,877,271
Other Europe		664,713
Other countries		353
Total		6,434,291
All other		667,876
Total		7,102,167
Total leather and leather manufactures		13,298,937

EXPORTS.

Country of import or export.	Quantity.	Value.
Sole leather:		
United Kingdom	26,924,895	4,960,378
Germany	218,063	47,857
Other Europe	3,605,978	736,875
British North America	727,835	147,982
West Indies and Bermuda	32,986	7,614
South America	94,607	21,829
Japan	1,549,594	386,745
British Australasia	161,896	41,203
Hawaii[a]	102,505	23,681
Philippine Islands	5,760	1,377
Other Asia and Oceania	130,783	31,151
Africa	466,569	98,100
Other countries	78,898	18,858
Total	34,100,389	6,523,540
Upper leather:		
United Kingdom		9,583,691
France		472,856
Germany		851,703
Other Europe		2,086,927
British North America		849,468

[a] The commerce between the United States and Hawaii and Porto Rico, respectively, is no included in the statements of the foreign trade of the United States after June 30, 1900, but the trade of Hawaii with foreign countries is included in the statement of the commerce of the United States after that date. The commerce of Porto Rico is shown separately.

Quantity and value of imports and exports of leather and leather manufactures for the year 1900—Continued.

EXPORTS—Continued.

Country of import or export.	Quantity.	Value.
Upper leather—Continued.	*Pounds.*	*Dollars.*
Central American States and British Honduras		38,117
Mexico		28,837
Santo Domingo		7,685
Cuba		42,464
Porto Rico		1,675
Other West Indies and Bermuda		32,482
Argentina		101,901
Brazil		99,502
Colombia		3,409
Other South America		66,824
British Australasia		634,128
Philippine Islands		8,045
Other Asia and Oceania		81,529
Africa		27,367
Other countries		419
Total		14,773,999
Boots and shoes:		
United Kingdom		1,094,672
France		82,446
Germany		142,029
Other Europe		60,697
British North America		400,021
Central American States and British Honduras		167,129
Mexico		350,964
West Indies and Bermuda		572,906
Colombia		68,049
Other South America		62,291
British Australasia		1,338,416
Hawaii *a*		102,648
Philippine Islands		7,515
Other Asia and Oceania		37,053
Africa		135,227
Other countries		4,193
Total		4,626,256
Harness and saddles		479,264
All other		765,955
Total leather and leather manufactures		27,169,014

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[a] The commerce between the United States and Hawaii and Porto Rico, respectively, is not included in the statements of the foreign trade of the United States after June 30, 1900, but the trade of Hawaii with foreign countries is included in the statement of the commerce of the United States after that date. The commerce of Porto Rico is shown separately.

MISCELLANEOUS EXPORTS.

Other items which are not included in previous tables of exports are given for 1900 in the following statement. The figures for 1899 are also given, in order that comparisons may be made:

Value of miscellaneous articles of export for 1899 and 1900.

[Compiled from reports of the Bureau of Statistics, Treasury Department.]

Article.	1899.	1900.
	Dollars.	*Dollars.*
Bones, hoofs, horns, etc	191,474	218,915
Candles	250,740	208,701
Feathers	258,365	302,467
Glue	229,815	224,809
Grease, grease scraps, etc	2,746,691	3,376,198
Hair and hair manufactures	585,305	698,236
Lard oil	462,441	367,122

COMMERCE WITH CUBA, PORTO RICO, AND PHILIPPINE ISLANDS.

Commerce of the United States in animals and animal products with Cuba, Porto Rico, and the Philippine Islands for the six months ended December, 1900.

	Cuba.				Porto Rico.				Philippine Islands.[a]	
	Imports.		Exports.		Imports.		Exports.		Exports.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Cattle ....No..			45,105	$867,037			1	$125		
Hogs ....No..			9,933	114,816						
Horses ....No..			3,003	151,095	1	$100	12	1,545	1,578	$115,160
Mules ....No..			1,434	142,765			15	1,000	1,175	117,500
Sheep ....No..			237	1,926						
All other, including fowls		$6,323		65,924		5				
Bones, hoofs, horns, etc.		5,995								45
Candles ....lbs..			11,481	963			147,631	13,481	60	12
Eggs ....doz..			1,624,185	298,663			800	181		
Feathers				39						
Feathers and down, crude		291								
Glue ....lbs..			38,694	4,828			2,691	283		
Grease, grease scraps, etc				30,863		116		820		
Hair and hair manufactures				393						
Hair, unmanufactured..		1,749				10				
Hides and skins, other than furs..........lbs..			7,094	2,235						
Goatskins ....lbs..	468	72			156	39				
Hides of cattle ....lbs..	4,717	491			154,402	16,239				
All other skins ....lbs..					75	15				

[a] The imports of the United States from Philippine Islands were: Manufactures of bones and horns, $156; crude feathers and down, $23.

Commerce of the United States in animals and animal products with Cuba, Porto Rico, and the Philippine Islands for the six months ended December, 1900—Continued.

	Cuba.				Porto Rico.				Philippine Islands.	
	Imports.		Exports.		Imports.		Exports.		Exports.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Leather and leather manufactures:										
Sole leather....lbs..			2,779	$528						
Kid, glazed				694						
Patent or enameled				151						
Splits, buff, grain, etc				19,743				$3,745		$1,550
All other leather				2,059				251		61
Boots and shoes, pairs			97,100	111,097			13,182	22,228	2,983	4,359
Harness and saddles				12,938				5,994		929
All other manufactures		$66		11,363		$24		3,000		456
Meat products:										
Meat and meat extracts		42								
All other		3,044								
Dairy products:										
Cheese.........lbs..	4,977	440	84,161	11,458			227,865	24,832	4,300	556
Butter.........lbs..			48,639	8,996			33,607	6,228	1,210	397
Milk				190,415				1,329		8,962
Beef products:										
Canned........lbs..			42,581	4,506			1,796	173	16,612	2,265
Fresh..........lbs..			804,460	84,025			268,688	27,187		
Salted or pickled, lbs			79,637	4,418			36,700	2,002		
Tallow.........lbs..			52,218	2,605			10,212	588		
Hog products:										
Bacon			2,793,088	223,298			452,442	31,648		
Hams			3,303,730	316,894			199,270	18,344	23,433	3,038
Pork, canned			1,280	145			2,400	191		
Pork, fresh			570	95						
Pork, salted or pickled			4,139,004	303,992			2,508,600	152,722		
Lard			19,407,208	1,387,256			1,841,985	128,936	57,380	5,027
Lard oil.......gals..			2,741	1,332			100	52		
Lard compounds and substitutes for (cottolene, lardine, etc.), lbs			65,901	4,333			12,195	1,014	9,000	650
Sausage and sausage meat.............lbs..			696,896	64,670			69,541	6,618		
Casings for sausages				4						
Mutton............lbs..			557	115			7,250	587		
Oleomargarine, imitation butter			331,346	37,855			122,165	11,694	100	13
Poultry and game				6,676				295		134
All other meat products:										
Canned				3,854				1,009		2,489
All other				19,713				12,685		1,610

Commerce of the United States in animals and animal products with Cuba, Porto Rico, and the Philippine Islands for the six months ended December, 1900—Continued.

	Cuba.				Porto Rico.				Philippine Islands.	
	Imports.		Exports.		Imports.		Exports.		Exports.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Wool and wool manufactures:										
Carpets......yards..	......	......	195	$114	......	......	384	$269	......	....
Flannels and blankets..........	......	......	....	757	......	......	....	....	......	....
Wearing apparel....	......	......	....	2,993	......	......	....	1,394	......	$535
All other manufactures of	......	......	....	835	......	......	....	1,157	......	184
Wool, hair of camel, goat, alpaca, etc.:										
Clothing, ready-made, etc	......	$26	....	....	......	$12	....	....	......	....
Cloths..............	11	29	....	....	......	......	....	....	......	....
All other............	......	14	....	....	......	......	....	....	......	....
Total values	......	18,578	....	4,521,474	......	16,560	....	488,547	......	265,932

STATISTICS OF THE ANIMAL INDUSTRY OF AUSTRALASIA.

The statistics quoted herewith are taken from "A statistical account of the seven colonies of Australasia, 1899–1900, by T. A. Coghlan, statistician of New South Wales." It is observed that a few minor errors occur in the tables, but it is impossible to know the particular sum which should be corrected. The errors are slight and do not materially change the relative importance of the facts.

The history of the live stock industry of Australasia can be traced back to the introduction of "1 bull, 4 cows, 1 calf, 1 stallion, 3 mares, 3 foals, 29 sheep, 12 pigs, and a few goats; and, although the whole of the present flocks and herds of Australasia have not sprung from these animals alone, yet the figures show the small scale on which the business of stock raising was first attempted."

The following table shows the number of different species of farm animals for various years, ended with the year 1899:

Number of sheep, cattle, horses, and swine for various years from 1792 to 1899.

Year.	Sheep.	Cattle.	Horses.	Swine.
	Number.	*Number.*	*Number.*	*Number.*
1792	105	23	11	43
1800	6,124	1,044	203	4,017
1810	33,818	11,276	1,114	8,992
1821	290,158	102,939	4,564	32,906
1842	6,312,004	1,014,833	70,615	66,086
1851	17,326,021	1,921,963	166,451	121,035
1861	23,741,706	4,039,839	459,970	362,417
1871	49,773,584	4,713,820	782,558	737,477
1881	78,063,426	8,709,028	1,249,765	903,271
1891	124,547,937	11,861,330	1,785,835	1,154,553
1899	93,645,309	11,049,065	1,932,247	1,180,896

It is noted that there was a steady increase in the numbers of all kinds of animals up to 1891, but the figures for 1899 show a decided decrease in sheep and a small decrease in cattle, while there is a small increase in horses and swine.

The table on the following page gives the number of sheep, cattle, horses, and swine in Australasia for various years for each head of population.

Number of sheep, cattle, horses, and swine for each head of population for various years.

Year.	Sheep.	Cattle.	Horses.	Swine.
	Number.	*Number.*	*Number.*	*Number.*
1861	18.8	3.2	0.4	0.3
1871	25.3	2.4	0.4	0.4
1881	27.7	3.1	0.4	0.3
1891	31.8	3	0.5	0.3
1899	21	2.5	0.4	0.3

"The following table shows the number of sheep in each colony at intervals of ten years since 1861 and at the end of 1899. In Victoria no live stock returns have been collected since 1894, and the figures for that colony in the last column, therefore, refer to that year:"

Number of sheep, by colonies, 1861 to 1899, by decades.

State.	1861.	1871.	1881.	1891.	1899.
	Number.	*Number.*	*Number.*	*Number.*	*Number.*
New South Wales	5,615,054	16,278,697	36,591,946	61,831,416	36,213,514
Victoria	6,239,258	10,002,381	10,267,265	12,928,148	13,180,943
Queensland	4,093,381	7,403,334	8,292,883	20,289,633	15,226,479
South Australia	3,038,356	4,412,055	6,810,856	7,745,541	5,721,493
West Australia	279,576	670,999	1,267,912	1,962,212	2,282,306
Tasmania	1,714,498	1,305,489	1,847,479	1,662,801	1,672,068
Commonwealth	20,980,123	40,072,955	65,078,341	106,419,751	74,296,803
New Zealand	2,761,583	9,700,629	12,985,085	18,128,186	19,348,506
Total	23,741,706	49,773,584	78,063,426	124,547,937	93,645,309

The next table shows the number of sheep in the various colonies for the years 1885 to 1899, both inclusive:

Number of sheep by colonies, 1885 to 1899, inclusive.

Year.	New South Wales.	Victoria.	Queensland.	South Australia.	West Australia.	Tasmania.	New Zealand.
	Number.	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*
1885	37,820,906	10,681,837	8,994,322	(*a*)	1,702,719	1,648,627	16,564,595
1886	39,169,304	10,700,403	9,690,455	(*a*)	1,809,071	1,609,046	(*a*)
1887	46,965,152	10,623,985	12,926,158	(*a*)	1,909,940	1,547,242	(*a*)
1888	46,503,469	10,818,575	13,444,005	(*a*)	2,112,392	1,430,065	15,468,860
1889	50,106,768	10,882,231	14,470,095	6,432,401	2,366,681	1,551,429	15,503,263
1890	55,986,431	12,692,843	18,007,234	7,050,544	2,524,913	1,619,256	18,128,186
1891	61,831,416	12,928,148	20,289,633	7,745,541	1,962,212	1,664,218	18,570,752
1892	58,080,114	12,965,306	21,708,310	7,209,500	1,685,500	1,623,338	19,380,369
1893	56,980,688	13,098,725	18,697,015	7,325,003	2,200,642	1,535,047	20,230,829
1894	56,977,270	13,180,943	19,587,691	(*a*)	2,132,311	1,727,200	19,826,604
1895	47,617,687	(*a*)	19,856,959	(*a*)	2,295,832	1,523,846	19,138,493
1896	48,318,790	(*a*)	19,593,696	6,402,593	2,248,976	1,650,567	19,687,954
1897	43,952,897	(*a*)	17,797,883	5,092,078	2,210,742	1,578,611	19,673,725
1898	41,241,004	(*a*)	17,552,608	5,076,696	2,251,548	1,493,638	19,348,506
1899	36,213,514	(*a*)	15,226,479	5,721,493	2,282,306	1,672,068	19,347,346

a Returns not collected.

Another table of interest is one showing the number of sheep and lambs slaughtered in the several colonies for the years 1895 to 1899, inclusive, and is as follows:

Number of sheep and lambs slaughtered, 1895 to 1899, inclusive.

Year.	New South Wales.	Victoria.	Queensland.	West Australia.	Tasmania (Hobart and Launceston).
	Number.	*Number.*	*Number.*	*Number.*	*Number.*
1895	8,363,003	2,326,002	....	....	104,315
1896	6,196,749	2,559,088	1,726,125	420,952	102,266
1897	5,790,103	2,434,519	1,902,735	505,091	107,223
1898	5,665,763	2,352,694	1,262,313	433,867	104,303
1899	4,795,259	....	1,497,546	....	93,913

The value of the sheep of Australasia in 1899, on the basis of the prices ruling during that year, was as follows:

New South Wales	$72,924,502.50
Victoria	29,525,055.50
Queensland	32,415,756.50
South Australia	12,180,849.50
Western Australia	5,596,475.00
Tasmania	4,379,850.00
Commonwealth	157,022,489.00
New Zealand	65,916,742.50
Total	222,939,231.50

Number of cattle, by colonies, for ten-year periods, 1861–1899, inclusive.

State.	1861.	1871.	1881.	1891.	1899.
	Number.	*Number.*	*Number.*	*Number.*	*Number.*
New South Wales	2,271,923	2,014,888	2,597,348	2,046,347	1,967,081
Victoria	628,092	799,509	1,286,677	1,812,104	1,833,900
Queensland	560,196	1,168,235	3,618,513	6,192,759	5,053,836
South Australia	265,434	143,463	314,918	676,933	526,524
Western Australia	33,795	49,593	63,009	133,690	297,081
Tasmania	87,114	101,540	130,526	167,666	160,204
Commonwealth	3,846,554	4,277,228	8,010,991	11,029,499	9,838,626
New Zealand	193,285	436,592	698,637	831,831	1,210,439
Total	4,039,839	4,713,820	8,709,628	11,861,330	11,049,065

Number of cattle, by colonies, for the years 1885 to 1899, inclusive.

Year.	New South Wales.	Victoria.	Queensland.	South Australia.	Western Australia.	Tasmania.	New Zealand.
	Number.	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*
1885	1,317,315	1,290,790	4,162,653	(*a*)	70,408	138,642	853,358
1886	1,367,844	1,303,265	4,071,563	(*a*)	88,254	148,665	(*a*)
1887	1,575,487	1,333,873	4,473,716	(*a*)	93,544	147,092	(*a*)
1888	1,622,907	1,370,660	4,654,932	(*a*)	95,822	142,019	853,358
1889	1,741,592	1,394,209	4,872,416	531,296	119,571	150,004	895,461
1890	2,091,229	1,782,881	5,558,264	574,032	130,970	162,440	831,831
1891	2,128,838	1,812,104	6,192,759	676,933	133,690	167,788	(*a*)
1892	2,221,459	1,824,704	6,591,416	631,522	162,886	170,085	851,801
1893	2,269,852	1,817,291	6,693,200	675,284	173,747	169,141	885,305
1894	2,465,411	1,833,900	7,012,997	(*a*)	187,214	177,038	964,034
1895	2,150,057	(*a*)	6,822,401	(*a*)	200,091	162,801	1,047,901
1896	2,226,163	(*a*)	6,507,377	638,591	199,793	157,736	1,138,572
1897	2,085,096	(*a*)	6,089,013	540,149	244,971	157,486	1,209,165
1898	2,029,516	(*a*)	5,571,292	618,894	269,947	149,754	1,203,024
1899	1,967,081	(*a*)	5,053,836	526,524	297,081	160,204	1,210,439

a Returns not collected.

Number of cattle and calves slaughtered, 1895–1899, inclusive, by colonies.[1]

Year.	New South Wales.	Victoria.	Queensland.	Western Australia.	Tasmania (Hobart and Launceston).
	Number.	*Number.*	*Number.*	*Number.*	*Number.*
1895	388,097	236,317	....	....	11,245
1896	351,246	245,477	474,946	30,664	9,393
1897	365,898	240,958	498,583	41,665	10,615
1898	364,042	244,319	572,735	83,203	10,029
1899	383,948	....	640,898	....	10,276

[1] No returns were received from colonies not here named.

The value of the cattle of Australasia in 1899, on the basis of the average prices ruling during that year, was as follows:

New South Wales	$48,694,199.00
Victoria	56,052,347.00
Queensland	74,807,838.00
South Australia	16,176,246.00
Western Australia	8,516,375.00
Tasmania	4,939,497.50
Commonwealth	209,186,502.50
New Zealand	45,818,097.50
Total	255,004,600.00

The number of horses in the several colonies of Australasia, by ten-year periods, for 1861 to 1899, inclusive, was as follows:

Number of horses, by ten-year periods, 1861–1899, inclusive.

State.	1861.	1871.	1881.	1891.	1899.
	Number.	*Number.*	*Number.*	*Number.*	*Number.*
New South Wales	233,220	304,100	398,577	459,755	482,200
Victoria	84,057	181,643	278,195	440,696	431,547
Queensland	28,983	91,910	194,217	399,364	479,127
South Australia	52,597	78,125	159,678	202,906	180,335
Western Australia	10,720	22,698	31,755	40,812	65,918
Tasmania	22,118	23,054	25,607	31,262	31,189
Commonwealth	431,695	701,530	1,088,029	1,574,795	1,670,316
New Zealand	28,275	81,028	161,736	211,040	261,931
Total	459,970	782,558	1,249,765	1,785,835	1,932,247

The value of the horses in these various colonies for 1899 is estimated as follows:

New South Wales	$18,765,224.00
Victoria	25,227,936.00
Queensland	11,655,267.50
South Australia	6,131,790.00
Western Australia	3,771,537.50
Tasmania	1,605,945.00
Commonwealth	67,157,700.00
New Zealand	16,575,299.00
Total	83,732,999.00

The quantity of wool produced in Australasia for the ten-year periods, 1861 to 1899, inclusive, is shown for the several colonies in the table below:

Quantity of wool produced, by colonies, by ten-year periods, 1861 to 1899, inclusive.

State.	1861.	1871.	1881.	1891.	1899.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
New South Wales	19,254,800	74,401,300	161,022,900	321,416,000	252,907,700
Victoria	27,168,900	63,641,100	67,794,300	69,205,600	64,853,700
Queensland	12,356,100	36,553,200	34,275,300	88,118,100	92,898,000
South Australia	13,756,500	28,242,100	46,013,900	50,151,500	37,327,900
Western Australia	820,500	1,888,000	4,654,600	9,501,700	10,795,300
Tasmania	5,129,100	6,687,800	10,525,100	10,102,900	9,114,800
Commonwealth	78,485,900	211,413,500	324,286,100	543,495,800	467,897,400
New Zealand	9,601,700	46,192,300	69,055,600	117,733,500	164,122,700
Total	88,087,600	257,605,800	393,341,700	661,229,300	632,020,100

The following table is an estimate of the average weight of fleeces for the ten-year periods of 1861 to 1899, inclusive.

Average weight of fleeces, by colonies, by ten-year periods, 1861 to 1899, inclusive.

State.	1861.	1871.	1881.	1891.	1899.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
New South Wales	3.28	4.57	4.47	5.74	6.53
Victoria	4.52	6.17	6.87	5.68	....
Queensland	3.40	4.73	4.50	4.73	5.67
South Australia	4.69	6.41	6.93	6.85	6.99
New Zealand	3.48	4.76	5.32	6.42	8.48

The comments of Mr. Coghlan concerning the frozen-meat trade of Australasia are so full of interest that it is deemed wise to copy them in full. They follow herewith:

THE FROZEN-MEAT TRADE.

In view of the large increase in the live stock of Australasia the question of the disposal of the surplus cast has become a matter of serious consequence. In New South Wales especially, and in the Riverina district in particular, it was found necessary to have recourse to the old method of boiling down, which a fortunate rise in the price of tallow made it possible to carry on with a margin of profit; but with such prices as have ruled for tallow during the past few years it can not be said that boiling down offers any inducement to the pastoralist, although in 1899 the production of tallow in the colony reached the large quantity of 389,838 hundredweight [of 112 pounds].

In New Zealand a much better solution of the question of disposal of the surplus cast was found, and a trade in frozen mutton with the United Kingdom has been established on a thoroughly payable basis—an example which some of the other colonies are endeavoring to follow, although considerably handicapped by the want of crossbred sheep and the prejudice of the English consumer against Merino mutton.

The first successful attempt at shipping frozen mutton to England was made in New Zealand in 1882, and since then the trade has attained great proportions, to the immediate benefit of the colonial producer as well as the English consumer. The trade initiated by the New Zealand Land Company has been extended by the formation of numerous joint-stock companies, which now own twenty-one meat-freezing works in the two islands having an aggregate capacity for freezing about 4,000,000 sheep per year. The sheep are generally killed upcountry and transported by rail to the freezing works. Several fleets of steamers are engaged in the trade, and the freight rates charged enable the companies to realize satisfactory profits. The growth of the frozen and preserved meat industries of New Zealand since 1881 is shown in the following table (p. 563). The shipments are almost exclusively made to the United Kingdom.

Shipments of frozen mutton (principally to the United Kingdom) for the years 1881 to 1899, inclusive.

Year.	Frozen or chilled meat.						Preserved meat.	
	Beef.	Mutton.	Lamb.	Mutton and lamb.	Total weight.	Total value.	Weight.	Value.
	Cwt.[1]	*Carcasses.*	*Carcasses.*	*Cwt.*[1]	*Cwt.*[1]	*Dollars.*	*Pounds.*	*Dollars.*
1881							1,074,640	108,965.80
1882					15,244	94,113.24	2,913,904	264,723.00
1883	937			86,995	87,932	575,517.16	3,868,480	354,174.14
1884	1,644			252,422	254,066	190,187.69	3,103,744	248,213.60
1885	9,170			286,961	296,131	1,816,790.98	4,047,904	396,137.97
1886	9,391			336,405	345,796	2,075,834.77	2,592,464	230,798.63
1887	6,630	656,823	110,816	421,405	428,035	2,213,975.24	4,706,016	385,650.66
1888	44,613	885,843	94,681	507,306	551,919	3,061,563.82	4,912,544	419,141.91
1889	68,298	990,486	118,794	588,524	656,822	3,812,289.57	5,325,152	519,605.94
1890	98,234	1,330,176	279,741	798,625	896,859	5,280,113.57	6,702,752	662,729.70
1891	103,007	1,447,583	338,344	889,012	992,019	5,767,396.21	5,447,904	540,828.74
1892	55,020	1,316,758	290,996	806,304	861,324	4,972,774.63	3,939,712	337,832.43
1893	11,059	1,355,247	475,365	888,455	899,514	5,248,164.99	2,656,416	226,783.77
1894	912	1,633,213	459,948	1,001,342	1,002,254	5,658,620.21	3,368,736	278,972.11
1895	12,090	1,632,590	735,254	1,078,640	1,090,730	5,911,717.14	4,124,400	321,855.71
1896	25,905	1,505,969	792,037	1,065,292	1,091,197	6,034,309.14	5,006,848	368,204.26
1897	50,044	1,653,170	1,038,316	1,291,582	1,341,626	7,359,539.82	5,046,216	380,730.63
1898	95,218	1,719,282	1,168,883	1,338,175	1,433,393	7,769,576.51	6,245,792	473,009.20
1899	172,345	2,102,533	1,272,525	1,557,439	1,729,784	9,565,417.21	5,382,272	442,457.31

[1] Of 112 pounds.

Among the continental colonies the export of meat has reached the largest dimensions in Queensland, although, of course, it consists chiefly of beef, the trade in mutton only forming one-eighteenth of the whole. So far as they can be given, the figures showing the growth of the Queensland frozen-meat trade, as well as the exports of preserved meat, will be found below:

The frozen-meat and preserved-meat trade of Queensland for the years 1881 to 1899, inclusive.

Year.	Frozen or chilled meat.				Preserved meat.	
	Beef.	Mutton.	Total weight.	Total value.	Weight.	Value.
	Cwt.[1]	*Cwt.*[1]	*Cwt.*[1]	*Dollars.*	*Pounds.*	*Dollars.*
1881					2,276,409	194,445.87
1882					5,689,189	580,782.71
1883			1,951	10,467.84	6,729,721	734,846.37
1884			8,082	54,699.46	2,298,696	277,882.02
1885			3,926	24,347.10	8,306,432	834,273.83
1856			9,289	58,899.25	130,658	7,718.27
1887					5,272,170	484,961.32
1888					3,964,419	379,037.09
1889	8,745	15,542	- 24,287	302,890.96	853,621	81,479.81
1890	30,253	23,799	54,052	369,406.28	2,769,881	214,320.66
1891	52,609	53,698	106,307	785,185.44	3,333,317	287,279.2g
1892	123,196	51,595	174,791	1,343,703.91	6,035,035	471,213.46
1893	204,349	21,898	226,247	1,834,860.29	8,001,788	696,620.10
1894	301,837	32,187	334,024	2,426,689.96	15,544,826	1,219,768.76
1895	461,733	28,221	489,954	2,824,949.72	25,941,400	1,914,928.82
1896	434,683	31,874	466,557	2,440,540.02	21,583,658	1,609,487.81
1897	529,162	31,162	560,324	3,208,288.79	15,699,098	1,173,746.27
1898	511,629	10,935	522,564	3,275,008.51	13,188,836	1,059,359.19
1899	651,029	32,529	683,558	4,057,361.64	25,148,815	1,868,244.48

[1] Of 112 pounds.

Next to New Zealand, the largest exporter of frozen mutton is New South Wales. During the last few years greater efforts have been made in this colony to expand the trade, and the exports show a considerable increase, although a temporary check was experienced in 1897 in consequence of the unfavorable season. But New South Wales has labored under the disadvantage of possessing no crossbred sheep for export, and the food qualities of the Merino are scarcely appreciated in the English market, where New Zealand mutton is favorably known and brings on an average 1¼d. per pound more than Australian. Large tracts of the mother colony, however, are suited to the breeding of large-carcass sheep, and the pastoralists have become alive to the importance of securing a share of the meat trade of the United Kingdom. Attention is being directed to the introduction of British rams into the colony, and a large increase in the crossbred flocks has already taken place. Up to the present, however, the crossbred carcasses sent by New South Wales to England have not been kept apart from the Merino and have therefore failed to return the higher prices which might have been expected. The attention of the freezing companies has been directed to this point, but so far without effect. The following table shows the growth of the frozen-meat trade of New South Wales. The exports of preserved meat consist almost wholly of tinned mutton.

The frozen-meat and preserved-meat trade of New South Wales for the years 1881 to 1899, inclusive.

Year.	Frozen or chilled meat.				Preserved meat.	
	Beef.	Mutton.	Total weight.	Total value.	Weight.	Value.
	Quarters.	*Carcasses.*	*Cwt.*[1]	*Dollars.*	*Pounds.*	*Dollars.*
1881	....	....	9,980	41,268.04	....	860,012.75
1882	....	....	13,782	111,491.52	....	698,834.27
1883	....	....	34,911	209,746.15	....	1,079,934.75
1884	....	....	13,809	59,960.15	....	785,827.82
1885	....	....	6,271	29,510.46	....	810,569.11
1886	....	....	4,852	22,731.42	....	378,399.57
1887	....	....	21,831	93,972.12	9,761,154	733,449.68
1888	....	....	52,262	216,739.31	4,528,269	338,129.29
1889	....	....	37,868	162,667.63	2,877,303	254,630.15
1890	....	....	72,304	348,120.21	4,655,523	361,722.08
1891	....	....	105,013	495,545.96	6,581,713	426,461.13
1892	....	....	223,074	824,506.76	8,620,747	515,469.41
1893	4,773	364,958	220,584	689,291.06	13,092,942	800,986.97
1894	9,538	533,995	339,404	942,933.04	16,382,597	1,002,761.79
1895	88,719	1,021,006	607,818	1,849,790.72	22,384,285	1,473,712.46
1896	16,286	1,372,373	612,188	1,671,141.50	16,351,936	1,062,318.02
1897	28,529	1,065,990	503,925	1,348,861.75	10,903,611	716,178.47
1898	39,593	1,095,568	539,495	1,607,526.61	13,930,801	1,106,097.05
1899	32,855	956,222	459,553	1,615,210.82	11,453,332	904,215.17

[1] Of 112 pounds.

The total capacity of the boiling-down works in New South Wales is stated at 633,900 head of cattle, or 16,965,000 sheep; of chilling works, 488,500 head of cattle, or 5,422,800 sheep; of freezing works, 76,500 head of cattle, or 3,150,000 sheep, and of meat-preserving works, 183,000 head of cattle, or 5,445,000 sheep.

The only other colony in which the meat-export trade has reached dimensions of any importance is Victoria, although its exports fall far below those of the three colonies already dealt with.

A statement of the Victorian trade from 1881 to 1899 will be found below:

The frozen-meat and preserved-meat trade of Victoria for the years 1881 to 1899, inclusive.

Year.	Frozen or chilled meat.				Preserved meat.	
	Beef.	Mutton.	Total weight.	Total value.	Weight.	Value.
	Cwt.[1]	*Cwt.*[1]	*Cwt.*[1]	*Dollars.*	*Pounds.*	*Dollars.*
1881					4,026,072	497,872.15
1882			18,522	92,312.64	1,274,066	149,425.88
883			9,944	59,468.63	3,225,657	369,926.99
1884			41,373	258,878.33	2,667,866	310,030.12
1885			39,107	299,859.13	1,486,849	186,114.43
1886			39,384	342,207.41	616,652	86,954.62
1887			15,245	122,709.46	629,054	69,547.15
1888					714,856	78,423.65
1889					805,580	78,623.17
1890					893,114	98,288.70
1891					1,052,887	93,582.80
1892					1,982,151	251,228.20
1893			1,307	8,944.63	777,953	69,829.41
1894	53	27,182	27,235	123,463.11	2,267,791	195,059.05
1895	268	24,563	24,831	154,136.65	2,917,730	211,245.03
1896	127	23,634	23,761	125,687.10	4,335,511	348,324.60
1897	62	21,416	21,478	98,536.89	5,498,315	413,233.98
1898	233	7,556	7,789	44,290.02	2,852,191	187,438.11
1899	1,458	74,960	76,418	418,942.39	4,760,047	244,171.77

[1] Of 112 pounds.

There are at present depastured [grazed] in Australasia 93,645,000 sheep and 11,049,000 cattle, of which 19,348,000 sheep and 1,210,000 cattle are in New Zealand. In that colony the industry of sheep and cattle raising has now reached such a stage that practically the whole of the stock available for market is used up every year either locally or for export, and as a consequence the numbers of both kinds of stock are stationary, and have been so for some years past. In the continental colonies a different state of things prevails. In New South Wales there is a large surplus of sheep beyond the colony's food requirements. While the cast of cattle is below the local demand, and is supplemented by the importation of stock from Queensland, the net import from that colony for the past three years being 482,428 head. The other four colonies have each a deficiency of cattle and sheep.

It is estimated that in an average year the cast of cattle is 10.25 per cent; that is to say, that that percentage of all the cattle depastured would be of marketable age could they be made fit for slaughtering. Excluding New Zealand, the annual cast would be 1,150,000 head. The present food requirements of the colonies may be set down at 750,000 head, leaving a balance of 400,000 as the surplus available, or which might be made available, for export. At the present time, however, some of the surplus is exported either as chilled beef or preserved meat, and it is estimated that 130,000 to 150,000 head are annually so disposed of, leaving about 250,000 head of age fit for market which it is unprofitable to keep beyond their present age. These comprise the real "surplus" difficulty of the colonies, and it is a question for experts to determine how many of the 250,000 could be fattened for export, but there seems to be abundant evidence that from 60,000 to 100,000 head of cattle could be exported in any ordinary year without trenching upon local requirements, while if the trade could be expanded without touching ruinous prices the export might be made much larger. The surplus of sheep can not be less than 4,500,000. These figures refer to an ordinary year. In 1899, which was a year of drouth, the available cast was doubtless much below the numbers quoted.

Looking at the question from all points of view, it can not be said that the frozen-meat trade is without strong elements of hope for the future. The great difficulty in the way of an expansion of the trade is the serious fall in prices; but there is no reason why better results should not be obtained if shippers are careful not to export anything of unsatisfactory quality, and so tend to enhance the value of Australian meat in the eyes of the British consumer. Signs are not wanting that the prejudice which existed against frozen mutton in the United Kingdom is fast dying out, and the adoption of the defrosting process, by which the meat may be placed on the market with a much more attractive appearance at an extra cost of one-fourth pence per pound, will hasten its extinction. That it is largely prejudice is made clear by the fact that a great deal of Australian mutton which is sent to London is sold to the consumer as Welsh or English.

During the years 1894 and 1895 several attempts, more or less successful, were made to place live cattle and sheep in the English market. A great difficulty in the way of establishing such a trade was the wildness of the cattle, the mortality in some of the shipments being sufficiently high to provoke strong criticism in England as to the cruelty to which the cattle were subjected by being shipped on such a long voyage. It is to be feared, however, that these expressions of opinion were prompted, not altogether by the alleged sufferings of the cattle, but to a large extent by the interests of the English producer and the American exporter. At the same time, it is clear that a permanent and profitable trade can not be established until the cattle have been handled sufficiently to bring them into a tractable condition, for the present system of depasturing followed in Australia renders the stock too wild to endure a long stay on shipboard. Probably, however, the great strides made by the Argentine Republic in supplying the English market will make it difficult for Australian shippers to realize a satisfactory margin of profit, the near proximity of that country to Great Britain giving it an immense advantage over these colonies in the matter of freights. In view of the vast population of the United States, any increase in the export of live cattle from that country can not be anticipated.

Several tables are copied herewith that give important statistics relative to dairy farming:

Number of dairy cows in 1899, quantity of milk produced, and value of milk, butter, and cheese, by colonies.

State.	Dairy cows.	Quantity of milk produced (estimated).	Value of milk butter, and milk.
	Number.	*Gallons.*	*Dollars.*
New South Wales	399,327	138,564,000	8,482,309.50
Victoria	464,469	193,044,000	12,122,451.50
Queensland	a 131,000	39,300,000	2,511,114.00
South Australia	84,498	28,351,000	1,776,272.50
Western Australia	a 22,500	6,535,000	335,788.50
Tasmania	41,482	16,669,000	764,040.50
Commonwealth	1,143,276	422,463,000	25,991,976.50
New Zealand	343,556	138,784,000	8,613,705.00
Total	1,486,832	561,247,000	34,605,681.50

a Estimated.

Quantity of butter and cheese produced in 1899, by colonies.

State.	Butter.	Cheese.
	Pounds.	*Pounds.*
New South Wales	33,034,000	2,386,000
Victoria	53,327,000	4,513,000
Queensland	8,463,000	1,910,000
South Australia	5,581,000	947,000
Western Australia	275,000	850
Tasmania	2,094,000	628,000
Commonwealth	102,774,000	10,384,850
New Zealand	30,940,000	13,430,000
Total	133,714,000	23,814,850

Quantity of butter exported to the United Kingdom, by colonies, 1889 to 1899, inclusive.

Year.	New South Wales.	Victoria.	Queensland.	South Australia.	New Zealand.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
1889	284,251	505,478	....	....	2,363,088
1890	589,160	1,286,583	....	10,850	2,976,848
1891	391,180	3,778,775	....	23,864	3,246,768
1892	1,532,782	6,446,900	....	....	4,648,980
1893	2,846,989	13,141,423	1,064	357,087	5,864,656
1894	4,333,927	22,139,521	....	1,233,539	6,590,640
1895	1,852,360	21,127,025	31,420	1,017,629	6,181,728
1896	1,741,272	16,452,649	....	242,872	6,730,304
1897	5,431,109	15,450,857	407,199	16,240	8,943,088
1898	5,309,811	13,548,293	628,296	389,836	9,051,168
1899	7,006,701	26,045,210	741,308	894,992	13,608,224

The breeding of swine in Australasia is usually carried on in connection with dairy farming. It will be observed that the industry is not large when compared with the same industry in our own country.

The following table shows the number of hogs, by colonies, for the ten-year periods 1861 to 1899:

Number of swine, by colonies, for the ten-year periods 1861 to 1899, inclusive.

State.	1861.	1871.	1881.	1891.	1899.
	Number.	*Number.*	*Number.*	*Number.*	*Number.*
New South Wales	146,091	213,193	213,916	253,189	239,773
Victoria	43,480	177,447	239,926	286,780	*a*337,588
Queensland	7,465	32,707	56,438	122,672	139,118
South Australia	69,286	95,542	120,718	83,797	84,262
Western Australia	11,984	14,265	22,530	25,930	55,953
Tasmania	40,841	52,863	49,660	73,520	74,451
Commonwealth	319,147	586,017	703,188	845,888	931,145
New Zealand	43,270	151,460	200,083	308,812	249,751
Total	362,417	737,477	903,271	1,154,700	1,180,896

a These figures are for 1894, no later returns having been received.

Value of eggs and poultry produced, by colonies, in 1899.

State.	Poultry and eggs.
	Dollars.
New South Wales	2,506,247.50
Victoria	2,267,789.00
Queensland	997,632.50
South Australia	958,700.50
Western Australia	637,511.50
Tasmania	330,922.00
Commonwealth	7,698,803.00
New Zealand	1,562,146.50
Total	9,260,949.50

LIVE STOCK AND THE MARKETS.

The receipts and shipments of live stock at the leading stock centers for the year 1900 are shown in the tables following. It is always well to state that these tables necessarily show many duplications; as, for instance, the animals reported at Lincoln are almost certain to be reported again for Omaha, and possibly a third time for Chicago.

Receipts and shipments of live stock, 1898–1900.

Animal.	1898.		1899.		1900.	
	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.
Cattle	9,529,480	4,502,216	9,721,577	4,302,421	10,135,096	4,954,400
Calves	768,864	176,766	1,018,217	197,335	991,321	169,555
Hogs	34,370,109	10,890,858	34,004,835	9,964,286	33,134,838	12,563,979
Sheep	13,100,157	5,679,200	13,343,559	5,606,431	15,535,925	7,545,409
Horses and mules	549,327	405,707	634,435	466,522	742,607	658,507
Total	58,317,887	21,654,747	58,722,623	20,536,995	60,539,787	25,891,850

In a general way, the difference between the receipts and shipments shows the number that was consumed in the city or was sold for packing purposes.

Summary of receipts and shipments of live stock at leading cities in 1900.

Stock center.	Cattle.		Calves.	
	Receipts.	Shipments.	Receipts.	Shipments.
Chicago	2,729,046	934,649	136,310	14,060
Kansas City	1,969,718	853,303	113,077	64,197
Omaha	828,204	274,479		
South St. Paul	176,172	134,645	44,509	19,698
Sioux City	300,437	187,424		
St. Louis	29,165	3,213	6,215	
National Stock Yards	698,370	165,824		
Indianapolis	139,722	139,722		
St. Joseph	379,967	379,810	10,414	10,378
Milwaukee	43,008	15,849	26,577	3,324
Pittsburg	251,285	253,391		
Lincoln	72,141	71,151		
Cincinnati	176,748	39,001	38,746	1,521
Cleveland	34,576	124	2,866	
Philadelphia	165,402	33,841	38,940	1,446
Baltimore	163,286	106,113	15,867	2,858
East Buffalo	653,906	580,646	37,500	4,750

Summary of receipts and shipments of live stock at leading cities in 1900—Continued.

Stock center.	Cattle.		Calves.	
	Receipts.	Shipments.	Receipts.	Shipments.
Louisville	94,284	31,873	9,421	535
Detroit	54,386	18,139	11,352	2,104
Jersey City	227,800	205,415	86,719	44,889
New York	210,456	37,790	245,993	....
Denver	239,606	240,532	....	....
Pueblo	71,028	71,049	....	....
Fort Worth	90,012	68,973	....	....
Portland, Oreg	21,010	11,180	....	....
San Francisco	39,737	....	2,870	....
New Brighton, Minn	84,354	85,082	....	....
Weehawken, N. J	19,800	11,182	53,845	....
Hoboken, N. J	....	....	....	....
Boston	171,470	....	110,100	....
Total	10,135,096	4,954,400	991,321	169,555

Stock center.	Hogs.		Sheep.		Horses and mules.	
	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.
Chicago	8,109,064	1,452,183	3,548,885	487,254	99,010	91,708
Kansas City	3,094,139	223,963	860,449	216,272	103,308	87,787
Omaha	2,200,926	36,996	1,276,775	552,234	59,645	54,845
South St. Paul	502,415	31,935	489,574	403,923	26,778	24,723
Sioux City	833,141	109,793	61,342	28,118	30,668	25,890
St. Louis	338,379	45,232	10,949	324	....	....
National Stock Yards	1,637,753	417,691	416,146	61,865	134,921	120,486
Indianapolis	1,323,018	1,323,018	67,005	67,005	32,973	32,973
St. Joseph	1,678,520	1,678,442	390,308	390,348	13,497	13,535
Milwaukee	349,438	4,378	47,355	18,426	3,056	2,227
Pittsburg	1,522,231	1,529,507	[a] 728,419	[a] 741,965	39,669	38,848
Lincoln	8,401	3,215	452,106	433,941	21,375	20,856
Cincinnati	866,757	291,808	346,980	248,162	....	....
Cleveland	970,753	466,238	132,276	2,726	....	....
Philadelphia	363,318	12,646	514,452	44,107	10,408	5,180
Baltimore	771,638	183,164	378,886	234,939	9,582	8,323
East Buffalo	4,484,800	3,530,560	1,647,000	1,331,800	59,880	56,297
Louisville	746,633	356,700	278,882	236,882	2,336	2,135
Detroit	329,837	47,942	110,728	46,915	351	215
Jersey City	652,367	657,202	1,658,132	1,233,458	1,111	....
New York	611,271	....	543,697	....	27,031	12,638
Denver	115,986	115,928	305,828	306,836	22,691	22,696
Pueblo	22,449	22,449	92,728	92,728	12,438	12,438
Fort Worth	147,697	2,400	12,795	12,135	3,378	3,332
Portland, Oreg	27,255	20,015	51,045	31,785	9,475	2,680
San Francisco	52,883	....	179,239	....	....	....
New Brighton, Minn	574	574	293,478	298,288	3,596	3,474
Weehawken, N. J	208,080	....	103,885	22,973	13,960	13,832
Hoboken, N. J	....	....	....	....	1,470	1,391
Boston	1,165,115	....	533,581	....	....	....
Total	33,134,838	12,563,979	15,535,925	7,545,409	742,607	658,507

[a] The sheep and calves are given together in the figures furnished to the Bureau.

Receipts and shipments of live stock at leading cities in 1900.

Stock yards at—	Cattle.		Calves.		Hogs.		Sheep.		Horses.	
	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.
CHICAGO.										
January	226, 649	65, 575	6, 348	287	816, 508	95, 399	336, 599	10, 236	11, 074	9, 334
February	196, 354	69, 482	6, 068	198	729, 254	139, 610	250, 008	19, 958	8, 529	8, 334
March	208, 076	75, 528	9, 083	471	642, 599	143, 670	260, 184	30, 864	11, 481	11, 923
April	213, 734	71, 802	14, 500	941	596, 467	113, 925	285, 366	29, 981	11, 110	9, 479
May	241, 309	84, 281	22, 982	1, 323	692, 506	140, 368	292, 050	18, 537	9, 791	9, 325
June	196, 102	73, 792	15, 876	1, 171	660, 216	137, 348	259, 647	17, 531	7, 591	7, 518
July	214, 673	74, 946	14, 371	631	502, 140	121, 575	281, 703	25, 861	6, 627	5, 900
August	245, 535	85, 336	11, 078	1, 603	577, 578	127, 755	334, 796	76, 250	8, 562	7, 731
September	239, 366	86, 007	10, 698	2, 292	590, 136	125, 887	316, 272	67, 704	8, 145	7, 569
October	273, 209	90, 141	10, 152	2, 386	739, 063	122, 829	373, 778	91, 045	6, 716	5, 862
November	252, 752	86, 879	9, 414	1, 470	802, 427	97, 668	303, 800	69, 588	4, 897	4, 681
December	225, 287	70, 880	5, 740	1, 287	760, 170	86, 149	254, 682	29, 699	4, 487	4, 047
Total	2, 733, 046	934, 649	136, 310	14, 060	8, 109, 064	1, 452, 183	3, 548, 885	487, 254	99, 010	91, 703
KANSAS CITY.										
January	146, 044	63, 463	4, 318	2, 880	294, 572	5, 746	63, 904	7, 433	10, 637	7, 981
February	118, 594	57, 136	3, 659	1, 962	227, 616	14, 886	70, 164	7, 226	8, 094	6, 010
March	134, 583	67, 697	3, 708	2, 589	255, 458	21, 281	80, 941	12, 116	6, 615	6, 059
April	120, 526	55, 680	3, 679	2, 800	268, 218	27, 499	65, 665	10, 931	7, 842	4, 759
May	140, 422	58, 331	1, 855	1, 105	319, 682	34, 931	97, 703	25, 256	5, 109	6, 471
June	109, 477	46, 828	5, 109	2, 031	306, 692	44, 687	60, 263	14, 467	8, 295	5, 916
July	131, 983	41, 752	11, 714	4, 171	259, 175	41, 741	52, 521	10, 368	7, 091	7, 004
August	212, 643	96, 001	14, 250	4, 624	190, 247	17, 989	70, 823	20, 847	8, 176	7, 371
September	239, 546	107, 849	17, 312	9, 247	179, 977	11, 624	70, 344	24, 253	9, 389	8, 794
October	289, 153	125, 967	23, 993	13, 665	241, 363	2, 860	122, 847	54, 733	13, 304	11, 022
November	205, 498	86, 784	16, 213	10, 973	273, 415	....	57, 519	19, 047	8, 795	7, 933
December	121, 249	45, 815	7, 267	8, 150	277, 724	719	47, 755	9, 595	9, 961	8, 467
Total	1, 969, 718	853, 303	113, 077	64, 197	3, 094, 139	223, 963	860, 449	216, 272	103, 308	38, 823

Receipts and shipments of live stock at leading cities in 1900—Continued.

Stock yards at—	Cattle.		Calves.		Hogs.		Sheep.		Horses.	
	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.
OMAHA.										
January	57,717	16,152	....	....	180,376	....	70,927	4,965	1,799	1,625
February	49,572	11,253	....	....	139,706	....	113,441	32,587	1,546	1,400
March	53,538	12,826	....	....	185,871	403	126,659	33,460	1,806	1,860
April	59,927	13,595	....	....	169,571	103	91,356	26,469	1,352	1,424
May	81,909	16,554	....	....	244,958	3,621	72,890	18,315	4,594	3,412
June	64,235	9,118	....	....	241,283	10,216	46,566	10,991	11,389	10,824
July	57,388	8,499	....	....	179,406	16,569	76,126	22,815	9,338	8,453
August	87,817	38,593	....	....	159,861	2,008	160,651	80,523	9,077	8,610
September	99,169	52,694	....	....	145,393	3,752	158,402	87,120	7,368	6,110
October	108,705	49,367	....	....	167,646	314	211,955	139,290	8,296	7,845
November	63,541	27,636	....	....	177,930	10	92,666	68,720	1,771	1,963
December	49,686	18,192	....	....	208,925	....	55,136	26,979	1,309	1,319
Total	828,204	274,479	....	....	2,200,926	36,996	1,276,775	552,234	59,645	54,845
SOUTH ST. PAUL.										
January	9,800	5,445	2,887	1,775	50,162	3,745	68,290	47,808	484	339
February	6,421	4,082	2,524	1,680	87,044	827	15,230	13,807	987	965
March	7,721	5,664	3,867	2,001	42,584	1,656	6,814	4,887	3,084	2,668
April	8,168	6,591	4,624	2,926	39,837	2,101	7,481	39,651	3,127	2,737
May	9,807	8,217	7,222	4,856	51,646	5,917	3,661	20,037	1,728	1,381
June	11,628	7,691	4,456	3,242	42,486	3,902	7,642	8,424	5,994	5,853
July	10,981	6,259	2,441	1,965	32,552	4,737	14,836	8,118	3,665	3,548
August	19,866	16,722	2,554	1,166	18,068	1,333	59,824	51,161	2,049	1,915
September	32,883	25,325	4,461	339	18,933	1,262	65,116	52,198	3,303	3,108
October	29,480	26,877	4,186	134	44,244	699	145,170	92,814	1,683	1,538
November	20,160	15,689	3,726	83	66,969	1,469	76,979	62,733	510	547
December	9,257	6,133	1,561	82	57,950	4,387	19,581	7,345	214	124
Total	176,172	134,645	44,509	19,698	502,415	32,035	489,574	403,923	26,778	24,723

SIOUX CITY.										
January	22,480	11,873	....	....	73,694	11,132	2,349	1,397	453	458
February	19,957	12,963	....	....	55,237	3,218	1,839	257	305	231
March	23,014	16,783	....	....	68,198	3,130	1,797	105	564	518
April	25,397	17,941	....	....	59,273	1,736	2,032	772	733	446
May	29,399	21,420	....	....	88,103	9,110	2,155	112	4,026	2,819
June	16,419	8,487	....	....	98,387	14,688	1,556	289	7,466	6,074
July	10,765	4,422	....	....	52,952	9,451	1,904	691	3,608	4,164
August	18,493	9,747	....	....	52,322	6,661	7,107	3,037	4,182	3,010
September	34,660	19,417	....	....	51,052	7,350	6,447	3,414	3,887	2,244
October	49,143	30,094	....	....	68,969	10,994	21,150	13,731	3,483	2,754
November	31,677	23,569	....	....	78,944	13,664	8,850	3,698	1,091	2,300
December	19,033	10,708	....	....	86,010	18,659	4,147	615	870	877
Total	300,437	187,424	....	....	833,141	109,793	61,342	28,118	30,668	25,890
ST. LOUIS.										
January	2,321	114	375	....	27,281	2,474	447	4	....	....
February	2,222	306	273	....	27,497	2,667	167	....	....	....
March	2,578	301	669	....	40,203	6,683	682	....	....	....
April	2,711	357	602	....	32,972	5,870	992	....	....	....
May	2,683	213	892	....	37,152	6,207	1,264	....	....	....
June	2,062	71	628	....	27,750	4,250	1,308	150	....	....
July	1,739	93	450	....	21,754	3,773	1,041	....	....	....
August	2,057	199	385	....	22,356	3,918	1,493	115	....	....
September	2,336	354	560	....	20,172	2,402	954	....	....	....
October	2,704	533	523	....	31,362	4,680	1,199	30	....	....
November	3,108	458	491	....	26,906	1,696	850	25	....	....
December	2,644	214	367	....	22,974	612	552	....	....	....
Total	29,165	3,213	6,215	....	338,379	45,232	10,949	324	....	....
NATIONAL STOCK YARDS.										
January	54,928	12,151	....	....	55,858	37,672	18,763	963	23,411	18,667
February	49,312	10,767	....	....	167,790	37,715	16,097	239	13,226	10,352
March	50,596	9,983	....	....	156,349	37,228	23,765	563	10,649	9,730
April	33,122	6,803	....	....	155,318	29,774	47,902	6,817	9,976	7,375

Receipts and shipments of live stock at leading cities in 1900—Continued.

Stock yards at—	Cattle.		Calves.		Hogs.		Sheep.		Horses.	
	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.
NATIONAL STOCK YARDS—continued.										
May	43,687	8,802			166,399	37,908	52,075	11,333	7,086	6,075
June	45,626	11,713			124,527	42,787	64,222	17,707	7,347	5,551
July	60,738	14,065			103,226	29,775	34,231	6,418	8,349	6,910
August	74,267	20,621			96,803	31,761	46,035	9,145	9,623	7,967
September	81,774	24,027			114,123	46,868	33,258	3,022	9,904	9,721
October	85,868	21,238			155,361	49,956	33,628	2,047	17,753	14,153
November	67,404	15,716			174,770	22,062	23,734	2,029	13,842	11,793
December	51,048	9,938			167,229	14,185	22,436	1,582	13,755	12,192
Total	698,370	165,824			1,637,753	417,691	416,146	61,865	144,921	120,486
INDIANAPOLIS.										
January	11,344	11,344			134,919	134,919	1,712	1,712	3,749	3,749
February	7,909	7,909			84,054	84,054	1,306	1,306	3,267	3,267
March	8,401	8,401			90,093	90,093	1,760	1,760	3,536	3,536
April	7,915	7,915			85,754	85,754	1,252	1,252	3,367	3,367
May	9,431	9,431			114,474	114,474	3,136	3,136	2,804	2,804
June	11,028	11,028			117,409	117,409	10,182	10,182	2,106	2,106
July	10,247	10,247			98,766	98,766	6,332	6,332	1,710	1,710
August	15,187	15,187			95,965	95,965	10,992	10,992	2,127	2,127
September	14,513	14,513			70,032	70,032	7,503	7,503	2,787	2,787
October	14,374	14,374			117,968	117,968	6,315	6,315	3,070	3,070
November	15,997	15,997			152,718	152,718	9,152	9,152	2,348	2,348
December	13,376	13,376			160,866	160,866	7,363	7,363	2,102	2,102
Total	139,722	139,722			1,323,018	1,323,018	67,005	67,005	32,973	32,973
ST. JOSEPH.										
January	22,830	22,684	572	446	134,074	133,824	12,639	12,697	714	737
February	22,568	22,306	232	256	116,301	116,326	18,273	18,271	920	926
March	22,418	22,584	428	534	136,464	136,680	32,567	32,571	785	844
April	25,368	25,358	330	324	132,477	132,467	39,305	38,776	753	705

May	35,362	35,014	277	257	157,945	157,609	51,682	52,026	623	675
June	30,818	30,786	282	321	182,992	181,466	43,429	42,891	498	496
July	31,237	31,630	2,022	1,983	168,129	168,019	25,086	25,078	1,912	1,887
August	42,943	22,709	702	685	117,467	117,488	55,717	52,868	1,943	1,898
September	43,405	43,399	2,055	998	115,750	116,421	53,625	50,305	1,574	1,534
October	51,896	71,767	2,316	3,313	114,923	115,987	33,222	39,495	2,133	2,131
November	32,335	32,623	788	871	146,587	146,341	14,550	14,140	1,135	1,126
December	18,787	18,950	410	391	155,411	155,814	10,213	10,630	507	576
Total	379,967	379,810	10,414	10,378	1,678,520	1,678,442	390,308	389,748	13,497	13,535
MILWAUKEE.										
January	3,350	1,124	1,549	147	44,619	498	2,581	1,153	58	76
February	2,767	2,767	1,211	1,211	26,075	687	1,631	1,631	117	117
March	3,349	846	1,830	180	28,931	....	1,430	322	315	168
April	3,027	700	2,292	35	21,066	....	696	168	164	164
May	3,429	451	2,819	234	32,415	703	1,418	212	229	92
June	2,706	497	2,837	112	22,154	269	3,681	817	284	263
July	2,024	421	3,272	507	14,657	157	3,178	161	368	353
August	2,861	638	3,082	247	16,221	187	5,588	494	304	142
September	4,351	1,754	2,125	222	14,556	601	4,817	1,104	565	351
October	4,950	1,138	2,110	155	39,823	953	6,405	1,880	213	161
November	5,896	3,206	1,872	247	45,368	162	10,333	7,810	242	242
December	4,298	2,307	1,578	27	43,553	161	5,597	2,674	197	98
Total	43,008	15,849	26,577	3,324	349,438	4,378	47,355	18,426	3,056	2,227
PITTSBURG.										
January	18,723	21,100	....	....	150,111	156,145	*a*45,270	*a* 48,372	3,802	3,692
February	20,628	21,061	....	....	126,077	125,152	39,904	40,326	3,918	3,848
March	17,846	26,175	....	....	129,251	134,476	36,048	37,182	4,983	4,916
April	17,314	18,456	....	....	103,865	105,158	39,915	38,577	3,946	3,811
May	18,682	18,733	....	....	115,314	112,129	62,996	63,333	2,909	2,811
June	18,138	17,566	....	....	102,624	105,354	108,733	107,665	2,229	2,189
July	22,149	22,768	....	....	97,714	98,612	96,544	97,688	1,703	1,681
August	23,841	23,889	....	....	110,347	106,014	92,823	96,285	2,831	2,809
September	26,249	23,222	....	....	137,776	114,418	60,651	58,067	3,815	3,656
October	22,763	25,821	....	....	132,769	137,279	43,309	50,292	3,678	3,665

a The sheep and calves are given together in the figures furnished to the Bureau.

Receipts and shipments of live stock at leading cities in 1900—Continued.

Stock yards at—	Cattle.		Calves.		Hogs.		Sheep.		Horses.	
	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.
PITTSBURG—continued.										
November	23,661	23,319	....	....	177,185	170,222	50,842	51,730	3,127	3,082
December	21,291	20,081	....	....	159,198	164,548	51,204	54,448	2,728	2,688
Total	251,285	262,191	....	....	1,542,231	1,529,567	728,239	743,965	39,669	38,848
LINCOLN.										
January	8,967	3,891	....	....	337	56	760	760	699	699
February	1,963	1,803	....	....	858	429	18,337	18,337	567	543
March	2,329	2,225	....	....	552	34	24,942	24,942	570	570
April	3,560	3,411	....	....	900	419	41,792	41,792	322	301
May	7,061	6,984	....	....	522	74	42,144	42,144	910	910
June	1,534	1,484	....	....	535	399	15,137	15,137	3,484	3,400
July	549	509	....	....	452	153	25,851	25,851	3,826	3,758
August	5,535	5,495	....	....	1,003	774	55,481	55,481	2,642	2,576
September	12,725	12,633	....	....	849	563	87,670	87,670	3,185	3,155
October	13,926	13,872	....	....	1,035	623	72,684	69,380	2,561	2,510
November	13,987	13,827	....	....	795	312	52,073	37,630	1,746	1,650
December	5,049	5,007	....	....	563	153	15,235	14,817	863	784
Total	72,185	71,141	....	....	8,401	3,989	452,106	438,941	21,875	20,856
CINCINNATI.										
January	13,213	2,036	2,570	124	94,019	30,627	9,292	8,725	....	....
February	11,968	1,904	2,435	48	80,616	24,908	6,749	2,198	....	....
March	12,451	1,718	3,402	50	75,998	26,757	7,207	2,493	....	....
April	14,719	3,217	3,927	235	69,713	22,953	7,163	2,201	....	....
May	15,473	2,939	4,899	251	73,341	22,394	14,829	6,368	....	....
June	13,497	2,142	4,036	74	65,895	18,893	72,684	62,231	....	....
July	12,772	2,231	3,104	64	48,627	12,474	84,418	67,621	....	....
August	13,747	2,771	3,099	23	48,221	12,522	70,516	62,140	....	....
September	17,263	4,648	2,982	119	52,459	15,583	80,483	18,136	....	....
October	18,924	5,123	3,536	292	86,511	28,777	21,221	10,000	....	....

November	17,858	5,328	2,442	193	100,319	38,608	11,942	5,704	....	....
December	14,863	4,944	2,364	58	71,538	37,362	10,481	5,339	....	....
Total	176,748	39,001	38,746	1,521	866,757	291,808	346,980	248,162	....	....
CLEVELAND.										
January	3,681	42	202	....	106,464	53,239	13,575	147	....	....
February	2,732	13	184	....	66,967	33,188	15,023	474	....	....
March	3,510	....	270	....	77,739	34,783	11,079	322	....	....
April	4,810	23	283	....	79,638	31,862	7,376	611	....	....
May	3,789	....	282	....	96,539	47,210	12,876	62	....	....
June	2,918	....	245	....	87,983	41,521	11,927	....	....	....
July	1,990	....	183	....	65,122	32,639	8,229	....	....	....
August	1,288	....	256	....	63,307	28,030	10,171	....	....	....
September	1,206	....	289	....	60,624	23,474	10,616	....	....	....
October	1,444	....	240	....	81,859	43,707	9,501	442	....	....
November	3,424	46	260	....	102,576	55,824	11,135	668	....	....
December	3,784	....	172	....	81,205	40,761	10,768	....	....	....
Total	34,576	124	2,866	....	969,753	466,238	132,276	2,726	....	....
PHILADELPHIA.										
January	11,764	1,334	2,402	9	37,323	2,344	28,062	3,168	750	324
February	11,108	1,428	2,696	....	33,202	2,070	30,358	675	965	596
March	9,661	1,745	3,731	53	25,642	1,409	23,644	1,947	997	759
April	14,332	2,208	3,523	29	32,986	625	29,729	2,535	1,000	559
May	13,481	2,543	4,270	45	27,186	266	32,105	4,577	880	477
June	12,814	3,323	3,651	71	20,933	381	36,764	5,671	919	435
July	14,590	3,664	3,035	109	26,688	364	51,588	5,119	972	316
August	13,910	3,908	3,408	139	23,572	569	52,376	7,931	860	290
September	14,274	3,524	3,539	331	27,104	711	61,745	4,111	813	365
October	18,350	4,076	3,345	376	35,432	799	64,086	3,929	719	402
November	15,567	2,932	3,154	227	34,914	1,718	59,012	2,311	798	301
December	15,556	3,161	2,186	57	38,336	1,390	44,783	2,133	735	356
Total	165,402	33,841	38,940	1,446	363,318	12,646	514,452	44,107	10,408	5,180
BALTIMORE.										
January	11,471	7,039	1,389	147	80,734	21,101	14,578	7,620	902	961
February	11,578	7,432	1,317	9	72,845	14,980	15,277	6,419	887	750
March	8,317	5,284	1,568	59	75,883	17,372	11,275	5,513	1,472	1,214

Receipts and shipments of live stock at leading cities in 1900—Continued.

Stock yards at—	Cattle.		Calves.		Hogs.		Sheep.		Horses.	
	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.
BALTIMORE—continued.										
April	11,002	6,364	1,772	204	65,834	14,178	17,694	7,904	940	821
May	10,623	5,333	2,039	200	63,029	13,939	23,198	11,567	710	598
June	9,480	6,327	885	382	57,381	10,338	45,176	32,669	290	311
July	11,660	7,294	1,054	446	50,213	9,959	65,942	51,114	167	104
August	13,951	10,116	871	652	48,925	10,693	54,630	41,001	255	157
September	18,894	12,957	1,398	285	58,411	13,893	48,486	24,682	633	471
October	23,751	16,202	1,452	180	65,892	18,648	39,524	24,624	1,304	1,115
November	18,151	11,608	1,199	....	70,605	18,850	22,573	9,834	969	874
December	13,408	10,157	923	89	61,886	19,218	20,538	11,987	1,053	947
Total	162,286	106,113	15,867	2,653	771,638	183,164	378,886	234,934	9,582	8,323
EAST BUFFALO.										
January	42,636	37,950	3,800	450	473,280	332,640	181,400	158,600	5,360	4,902
February	39,292	34,562	3,400	300	385,600	308,320	163,600	139,400	5,240	5,662
March	42,394	38,170	2,600	400	369,760	296,160	152,600	139,000	8,580	7,467
April	45,408	37,972	3,300	500	333,920	261,120	152,800	116,200	8,440	8,227
May	55,594	50,028	2,000	200	367,040	288,320	128,200	99,400	6,740	6,688
June	57,024	51,018	2,300	300	343,520	270,880	85,200	65,200	5,500	5,339
July	60,434	55,088	2,500	500	304,800	243,840	85,400	62,600	2,400	2,660
August	62,304	57,904	2,500	300	309,920	248,640	86,000	60,400	3,580	3,249
September	63,316	55,902	6,100	300	298,720	241,280	145,400	90,000	4,680	4,123
October	63,470	55,638	3,400	500	345,440	291,200	140,400	118,200	3,200	2,793
November	64,262	55,440	2,300	500	494,560	376,480	163,000	130,400	3,080	2,584
December	57,772	50,974	3,300	500	494,240	371,680	163,000	152,400	3,080	2,603
Total	653,906	580,646	37,500	4,750	4,520,800	3,580,560	1,647,000	1,331,800	59,880	56,297
LOUISVILLE.										
January	11,954	5,226	635	121	95,760	60,009	1,442	897	427	314
February	7,927	3,014	645	22	76,446	44,942	2,348	1,503	189	186
March	6,760	1,514	917	101	65,581	43,130	8,563	2,936	220	214

April	5,378	1,119	988	....	58,794	21,695	6,672	3,883	103	120
May	6,198	1,154	1,036	10	53,729	13,106	13,658	9,521	108	162
June	5,021	992	1,008	57	37,994	9,190	91,035	83,468	49	22
July	5,354	888	755	10	26,996	6,161	82,270	72,786	2	2
August	6,865	1,950	756	10	26,335	8,702	51,145	46,164	237	177
September	9,927	3,918	728	45	40,818	12,768	16,230	11,719	126	135
October	10,917	5,024	736	22	84,090	46,726	5,426	2,284	269	267
November	10,250	4,236	664	41	99,974	48,851	3,249	1,047	255	267
December	8,433	2,604	553	78	80,166	39,484	1,844	676	271	265
Total	94,984	31,639	9,421	517	746,633	354,764	278,882	225,884	2,256	2,131
DETROIT.										
January	3,183	847	825	513	31,345	4,562	13,625	8,815	25	24
February	4,077	1,473	863	249	26,735	3,938	14,459	9,902	46	35
March	3,018	894	879	279	23,252	4,192	7,946	3,518	23	23
April	5,442	2,708	1,372	14	32,083	6,541	8,926	4,652	116	20
May	3,755	1,215	1,255	90	25,220	3,797	5,572	1,569	2	....
June	3,984	1,265	982	18	24,052	1,553	4,089	287	....	....
July	5,657	2,371	978	101	27,550	1,085	5,627	609	....	....
August	4,686	1,729	702	41	20,285	2,516	6,180	1,739	32	32
September	4,420	1,312	718	47	25,538	2,500	8,481	2,452	27	26
October	6,009	1,701	1,170	301	31,789	5,176	12,990	4,573	80	55
November	5,690	1,679	795	236	31,278	8,064	11,006	4,169	....	....
December	4,465	945	813	215	30,710	4,018	11,827	4,630	....	....
Total	54,386	18,139	11,352	2,104	329,837	47,942	110,728	46,915	351	215
JERSEY CITY.										
January	20,565	18,374	4,156	2,559	64,442	69,426	129,360	105,590	49	....
February	17,281	15,327	4,163	2,863	48,812	48,771	101,932	80,622	164	....
March	16,943	15,483	6,488	4,059	45,898	45,883	86,433	67,116	117	....
April	16,802	15,467	11,207	6,530	38,704	38,688	75,863	61,476	100	....
May	18,290	16,494	13,403	5,283	45,265	45,250	119,353	97,785	134	....
June	14,867	13,147	9,016	2,016	31,554	31,547	177,869	134,325	81	....
July	16,980	15,507	6,593	2,563	33,522	33,507	169,491	121,724	82	....
August	20,292	16,674	8,810	5,592	63,251	63,240	210,437	164,329	108	....
September	20,265	18,484	6,456	3,988	53,824	53,821	171,937	133,282	106	....
October	22,715	20,990	7,353	4,764	76,047	76,031	174,714	122,138	80	....

Receipts and shipments of live stock at leading cities in 1900—Continued.

Stock yards at—	Cattle.		Calves.		Hogs.		Sheep.		Horses.	
	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.
JERSEY CITY—continued.										
November	21,122	19,726	5,177	2,838	81,586	81,582	129,211	81,148	25	....
December	21,678	19,742	3,897	1,834	69,462	69,456	110,582	63,923	65	....
Total	227,800	205,415	86,719	44,889	652,867	657,202	1,658,132	1,233,458	1,111	....
NEW YORK.										
January	10,729	2,552	8,058	....	58,236	....	47,373	....	1,175	163
February	8,183	1,592	11,185	....	58,431	....	44,679	....	1,454	414
March	18,443	2,592	18,384	....	49,246	....	39,573	....	2,961	1,190
April	20,116	2,813	89,368	....	56,601	....	43,255	....	3,807	1,082
May	15,960	2,919	37,414	....	45,623	....	83,447	....	3,591	1,483
June	18,666	3,662	39,512	....	43,780	....	9,106	....	2,629	1,918
July	17,955	4,070	22,804	....	47,913	....	12,991	....	1,950	1,057
August	22,577	3,111	25,114	....	85,337	....	22,982	....	2,011	1,244
September	19,818	3,905	17,413	....	48,124	....	59,499	....	2,675	1,364
October	17,668	3,804	9,002	....	47,823	....	69,813	....	2,067	1,018
November	23,632	3,370	12,615	....	56,597	....	95,983	....	1,598	776
December	16,709	3,400	5,124	....	63,560	....	65,046	....	1,613	929
Total	210,456	37,790	245,993	....	611,271	....	543,697	....	27,031	12,638
DENVER.										
January	13,321	13,474	....	....	13,581	13,581	4,309	5,288	355	360
February	9,926	10,280	....	....	8,775	8,775	6,696	6,696	518	518
March	6,395	6,313	....	....	9,555	9,555	4,645	4,645	235	235
April	11,018	10,938	....	....	8,565	8,565	6,856	6,856	379	379
May	51,050	45,397	....	....	10,966	10,966	10,912	10,912	2,389	2,351
June	34,273	40,032	....	....	7,440	7,440	7,166	7,166	4,030	4,040
July	10,108	10,374	....	....	8,866	8,866	15,982	15,982	4,405	4,407
August	14,992	13,558	....	....	8,353	8,353	35,498	34,993	2,427	2,222
September	17,967	17,830	....	....	9,846	9,846	30,978	30,094	2,245	2,437
October	25,898	25,506	....	....	10,373	10,373	105,830	103,028	3,433	3,472

November	31,098	29,881			11,731	11,731	54,397	57,365	1,358	1,219
December	13,572	16,949			7,935	7,877	23,059	23,711	917	1,056
Total	239,606	240,532			115,986	115,928	305,828	306,836	22,691	22,696
PUEBLO.										
January	3,517	3,538			2,739	2,739	226	226	743	667
February	2,862	2,862			1,997	1,997	293	293	268	344
March	2,315	1,868			2,269	2,269	37	37	229	203
April	2,570	1,760			1,577	1,577	877	877	4	30
May	26,890	28,044			1,516	1,516	468	468	421	421
June	12,007	10,438			1,463	1,463			1,081	1,081
July	1,892	3,460			1,518	1,518	4,358	4,358	1,936	1,849
August	3,363	3,362			1,639	1,639	13,120	13,120	1,839	1,922
September	2,864	2,969			1,847	1,847	6,515	6,515	1,841	1,845
October	6,038	6,038			1,742	1,742	48,309	48,309	2,038	2,038
November	3,959	3,928			2,249	2,249	17,589	17,589	1,172	1,172
December	2,751	2,782			1,893	1,893	936	936	866	866
Total	71,028	71,049			22,449	22,449	92,728	92,728	12,438	12,438
FORT WORTH.										
January	11,255	10,118			16,975	636	1,349	1,347	68	68
February	1,583	941			15,188	81	14		209	209
March	5,366	3,300			17,450	924	56	17	162	162
April	2,411	835			16,768		52		183	183
May	24,735	24,188			15,812	278	5,949	5,848	158	160
June	3,806	2,508			8,196		1,778	1,727	153	152
July	2,787	1,647			6,674	91	107	43	235	235
August	2,521	1,563			7,278		13		269	209
September	3,358	2,119			9,160	71	1,467	1,248	396	371
October	7,150	1,158			10,916	143	356	251	384	564
November	15,321	12,620			11,530	176	1,494	1,494	571	571
December	9,719	7,976			11,755		160	160	390	888
Total	90,012	68,973			147,697	2,400	12,795	12,135	3,378	3,332
PORTLAND, OREG.										
January	865	855			1,515	1,450	3,470	1,850	500	160
February	1,465	765			1,010	715	4,840	1,010	345	130
March	1,495	1,085			2,365	885	3,860	1,640	220	195

Receipts and shipments of live stock at leading cities in 1900—Continued.

Stock yards at—	Cattle.		Calves.		Hogs.		Sheep.		Horses.	
	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.
JERSEY CITY—continued.										
ber	21,122	19,726	5,177	2,838	81,586	81,582	129,211	81,148	25	....
	21,678	19,742	3,897	1,834	69,462	69,456	110,582	63,923	65	....
	227,800	205,415	86,719	44,889	652,367	657,202	1,658,132	1,233,458	1,111	....
NEW YORK.										
	10,729	2,552	8,058	....	58,236	....	47,373	....	1,175	163
ary	8,183	1,592	11,185	....	58,431	....	44,679	....	1,454	414
	18,443	2,592	18,384	....	49,246	....	39,573	....	2,961	1,190
	20,116	2,813	39,368	....	56,601	....	43,255	....	3,307	1,082
	15,960	2,919	37,414	....	45,623	....	33,447	....	3,591	1,483
	18,666	3,662	39,512	....	43,780	....	9,106	....	2,629	1,918
	17,955	4,070	22,804	....	47,913	....	12,991	....	1,950	1,057
	22,577	3,111	25,114	....	35,337	....	22,982	....	2,011	1,244
	19,818	3,905	17,413	....	48,124	....	59,499	....	2,675	1,364
	17,668	3,804	9,002	....	47,823	....	69,813	....	2,067	1,018
	23,632	3,370	12,615	....	56,597	....	95,983	....	1,598	776
	16,709	3,400	5,124	....	63,560	....	65,046	....	1,613	929
	210,456	37,790	245,993	....	611,271	....	543,697	....	27,031	12,638
VER.										
	13,321	13,474	....	....	13,581	13,581	4,309	5,288	355	360
	9,926	10,280	....	....	8,775	8,775	6,696	6,696	518	518

Receipts and shipments of live stock at leading cities in 1900—Continued.

Stock yards at—	Cattle.		Calves.		Hogs.		Sheep.		Horses.	
	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.
PORTLAND, OREG.—continued.										
April	2,655	2,195	....	....	1,970	1,465	5,490	3,870	95	60
May	4,470	1,765	....	....	1,695	1,635	8,200	4,660	1,335	265
June	1,075	1,245	....	....	1,520	1,890	4,885	4,370	1,695	115
July	1,940	850	....	....	970	1,375	4,060	2,930	1,080	480
August	1,280	610	....	....	2,420	1,885	4,930	3,600	1,435	745
September	1,820	1,050	....	....	4,240	2,745	2,900	2,495	905	50
October	2,005	620	....	....	3,610	2,615	3,405	2,170	610	405
November	1,335	325	....	....	3,530	1,900	3,710	1,595	410	25
December	605	315	....	....	2,410	1,455	4,795	1,595	845	50
Total	21,010	11,180	....	....	27,255	20,015	54,045	31,785	9,475	2,680
SAN FRANCISCO.										
January	3,368	....	166	....	3,507	....	11,405	....	....	....
February	2,653	....	148	....	3,511	....	13,141	....	....	....
March	3,537	....	116	....	6,432	....	15,905	....	....	....
April	2,662	....	23	....	3,288	....	12,374	....	....	....
May	3,895	....	355	....	5,564	....	17,490	....	....	....
June	3,140	....	214	....	3,054	....	16,155	....	....	....
July	2,736	....	273	....	2,753	....	15,231	....	....	....
August	4,285	....	370	....	4,057	....	18,972	....	....	....
September	3,188	....	295	....	4,424	....	15,605	....	....	....
October	3,581	....	225	....	5,309	....	14,772	....	....	....
November	4,374	....	421	....	6,297	....	16,308	....	....	....
December	2,318	....	264	....	4,683	....	11,881	....	....	....
Total	39,737	....	2,870	....	52,879	....	179,239	....	....	....
NEW BRIGHTON, MINN.										
January	....	....	....	....	39	39	34,559	64,135	....	....
February	....	....	....	....	....	....	12,211	15,317	20	....

March	282	282					6,019	11,465	168	168
April	296	1,080			7	7	2,200	22,235	5	
May	59	396					2,200	20,199	319	314
June	135	135					1,278	3,915	11	11
July	6,405	6,409			45	45	11,413	11,413	368	286
August	21,884	21,884					20,384	20,384	773	795
September	28,836	28,836					52,881	50,397	598	593
October	21,222	21,222			27	27	85,732	45,624	883	856
November	5,235	4,838					42,857	20,537	451	451
December					456	456	21,744	12,667		
Total	84,354	85,082			574	574	293,478	298,288	3,596	3,474
WEEHAWKEN, N. J.										
January	792	15	1,867		23,617		13,814	3,013	2,935	2,676
February	283	191	2,135		18,014		6,387	1,010	1,902	1,997
March	1,561	1,088	3,654		18,017		5,463	1,051	1,813	1,763
April	1,114	989	7,238		17,137		4,298		1,181	1,884
May	2,016	1,100	8,317		16,843		3,739	1,728	1,544	1,649
June	2,144	1,153	7,084		13,843		1,886	994	1,005	1,127
July	2,215	1,210	5,738		15,158		3,446	1,689	600	396
August	2,332	1,248	5,152		13,803		9,479		680	579
September	1,989	1,255	4,025		14,957		12,814	1,057	983	866
October	2,400	749	3,741		17,456		11,158	1,184	594	368
November	2,085	1,479	2,785		19,261		14,772	5,404	338	126
December	869	705	2,109		19,974		16,629	5,843	385	401
Total	19,800	11,182	53,845		208,080		103,885	22,973	13,960	13,832
HOBOKEN, N. J.										
The year									1,470	1,391
BOSTON.										
The year	171,470		110,100		1,165,115		533,581			

Range or average price, per hundredweight, of cattle at Chicago and Omaha, 1900.

CHICAGO.

Month.	Native steers (1,500-1,800 pounds).		Native steers (1,200-1,500 pounds).		Poor to choice cows and heifers.		Native stockers and feeders.		Straight Texans and Westerns.	
January	$5.15 to	$6.60	$4.30 to	$6.60	$2.25 to	$5.25	$2.90 to	$4.90	$3.60 to	$5.90
February	4.80	6.10	4.10	6.10	2.25	5.00	3.35	5.00	3.50	5.15
March	4.75	6.05	4.20	6.00	2.20	4.75	3.00	4.90	3.55	5.40
April	4.85	6.00	4.30	5.85	2.25	5.00	3.50	5.25	3.60	5.40
May	4.90	5.80	4.50	5.85	2.50	5.45	3.60	5.15	3.90	5.05
June	5.10	5.90	4.75	5.85	2.25	5.30	2.50	5.20	3.10	5.35
July	5.15	5.75	4.70	5.85	2.25	5.15	2.60	4.75	3.10	5.40
August	5.30	6.10	4.85	6.20	2.25	5.40	2.50	4.80	3.00	5.35
September	5.20	6.00	4.60	6.15	2.25	5.50	2.50	5.60	3.20	5.35
October	5.15	6.00	4.45	6.00	1.75	5.00	2.10	4.60	3.25	5.05
November	5.00	6.00	4.20	6.00	1.75	5.20	2.25	4.65	3.35	5.60
December	4.70	*a* 15.50	3.90	*a* 11.00	1.75	6.00	2.20	4.50	3.40	5.90
Range:										
1900	4.70	*a* 15.50	3.90	*a* 11.00	1.75	6.00	2.10	5.25	3.00	5.90
1899	4.60	8.50	4.00	8.25	2.00	6.85	2.50	5.40	3.10	6.75
1898	4.10	6.25	3.80	6.15	2.00	5.40	2.50	5.40	3.15	5.40
1897	4.00	6.00	3.35	6.00	1.75	5.40	2.40	4.75	2.75	4.90
1896	3.40	6.50	2.90	6.25	1.75	4.40	2.20	4.10	2.10	5.50
1895	3.60	6.60	2.90	6.40	2.00	5.75	2.25	5.15	2.25	5.75
1894	3.00	6.00	2.90	6.00	1.75	4.40	2.00	4.15	2.50	5.00
1893	4.00	6.75	2.90	6.50	2.00	5.00	2.25	4.90	3.50	6.00
1892	3.75	7.00	2.85	6.35	1.85	4.00	2.00	4.10	1.50	5.25

a 15 Aberdeen-Angus steers, 1,492 pounds, sold at $15.50; 15 Aberdeen-Angus steers, 1,498 pounds, sold at $11; 15 Illinois-fed Texas steers, 1,431 pounds, sold at $9.30. These were show cattle.

OMAHA.

Month.	Native beeves.		Native cows.		Stockers and feeders.		Western steers.		Western cows.	
January	$4.00 to	$6.25	$2.25 to	$4.75	$3.00 to	$5.15	$3.50 to	$5.10	$2.25 to	$3.75
February	3.75	5.55	2.00	4.75	3.00	5.10	......	.....	....	....
March	3.75	5.20	2.00	4.50	3.00	5.00	3.25	4.85	2.00	3.40
April	3.75	5.25	2.00	4.70	3.00	5.20	......	.....	....	....
May	4.00	5.30	2.00	5.00	3.00	5.50	4.00	5.00	2.00	4.30
June	4.00	5.40	2.25	4.75	3.00	5.00	3.50	4.50	3.00	3.50
July	4.00	5.50	2.00	4.75	3.00	4.75	3.50	4.70	2.00	4.35
August	4.00	5.80	1.50	4.85	3.00	4.60	3.25	5.00	2.00	4.25
September	3.75	5.70	1.50	5.00	3.00	4.75	3.25	4.75	1.75	4.05
October	3.75	5.50	1.50	4.50	3.00	4.75	3.00	4.90	1.50	4.00
November	3.75	5.50	1.00	4.50	3.00	4.50	3.00	4.60	1.50	4.30
December	3.50	7.50	1.00	5.20	3.00	5.00	1.50	3.70	3.00	4.90

Range or average price, per hundredweight, of hogs at Chicago and Omaha, 1900.

CHICAGO.

Month.	Heavy packing (250–500 pounds).		Mixed packing (200–250 pounds).		Light bacon (150–200 pounds).	
January	$4.15 to	$4.92½	$4.15 to	$4.90	$4.10 to	$4.80
February	4.60	5.10	4.60	5.10	4.55	5.00
March	4.35	5.52½	4.65	5.47½	4.30	5.40
April	5.10	5.85	5.15	5.82½	5.05	5.75
May	4.90	5.57½	4.95	5.52½	4.90	5.47½
June	4.85	5.42½	4.90	5.40	4.90	5.40
July	4.85	5.50	4.95	5.55	4.95	5.52½
August	4.75	5.52½	4.90	5.57½	5.00	5.57½
September	4.80	5.62½	4.95	5.70	5.05	5.70
October	4.35	5.52½	4.40	5.52½	4.30	5.55
November	4.40	5.10	4.45	5.12½	4.35	5.12½
December	4.40	5.10	4.50	5.07½	4.50	5.07½
Range:						
1900	4.05	5.85	4.05	5.82½	4.00	5.75
1899	3.35	4.95	3.40	5.00	3.30	5.00
1898	3.10	4.80	3.10	4.70	3.10	4.65
1897	3.00	4.45	3.20	4.50	3.20	4.65
1896	2.40	4.45	2.75	4.45	2.80	4.45
1895	3.20	5.45	3.25	5.55	3.25	5.70
1894	3.90	6.75	3.90	6.55	3.50	6.45
1893	3.80	8.75	4.25	8.65	4.40	8.59
1892	3.70	7.90	3.60	6.85	3.60	6.85

OMAHA.

Month.	Heavy packing (275–500 pounds).		Mixed packing (230–270 pounds).		Light bacon (150–225 pounds).	
January	$4.22½ to	$4.72½	$4.20 to	$4.67½	$4.15 to	$4.65
February	4.60	4.90	4.60	4.85	4.40	4.85
March	4.50	5.17½	4.62½	5.25	4.62½	5.25
April	5.00	5.55	5.00	5.60	5.10	5.62½
May	4.80	5.40	4.80	5.30	4.50	5.27½
June	4.80	5.25	4.77½	5.22½	4.57½	5.15
July	4.85	5.25	4.80	5.20	4.75	5.20
August	4.80	5.25	4.85	5.20	4.75	5.25
September	4.90	5.35	4.95	5.32½	4.95	5.30
October	4.40	5.25	4.45	5.25	4.25	5.20
November	4.40	4.90	4.40	4.95	4.30	4.97½
December	4.60	4.95	4.60	4.90	4.55	5.00

Range or average price, per hundredweight, of sheep at Chicago and Omaha, 1900.

CHICAGO.

Month.	Native sheep (60–140 pounds).		Native yearlings and lambs.		Western sheep (70–140 pounds).		Western and Mexican lambs.	
January	$2.60 to	$5.25	$4.00 to	$7.00	$3.40 to	$5.15	$5.00 to	$7.00
February	2.75	5.90	5.00	7.30	4.25	5.90	5.75	7.35
March	3.50	6.10	5.00	7.60	4.75	6.10	6.00	7.60
April	3.50	6.50	4.50	7.50	5.10	6.50	5.80	7.55
May	3.50	6.00	4.00	7.30	4.75	5.75	5.90	7.55
June	2.50	5.50	4.00	6.80	3.85	5.40	6.25	7.50
July	2.50	4.60	3.50	7.00	3.00	4.60	5.25	6.25
August	2.50	4.65	4.00	6.15	3.15	4.75	5.00	5.85
September	2.00	4.25	3.25	6.00	3.00	4.25	4.00	5.90
October	2.50	4.25	3.50	5.75	3.00	4.15	4.00	5.50
November	2.25	4.35	3.50	5.75	3.50	4.40	4.15	5.25
December	2.25	5.00	3.00	6.75	3.50	4.80	4.20	5.50
Range:								
1900	2.00	6.50	3.00	7.60	3.00	6.50	4.00	7.60
1899	2.25	5.65	3.50	7.45	2.55	5.55	4.00	7.00
1898	2.00	5.25	3.50	7.10	3.00	5.25	3.75	6.75
1897	1.25	5.25	3.00	6.40	2.15	5.35	3.50	7.25
1896	1.00	4.60	2.75	6.50	2.15	4.30	3.50	6.25
1895	1.25	5.50	2.25	6.35	2.50	5.35	3.00	6.00
1894	1.00	5.40	2.00	6.00	2.00	5.40	2.50	5.80
1893	5.50	6.25	2.25	7.55	2.50	6.45	2.25	6.75
1892	2.25	6.90	3.00	8.25	3.00	6.75	3.50	7.25

OMAHA.

Month.	Native sheep.		Native lambs.		Western sheep.		Western lambs.	
January	$3.25 to	$5.25	$4.75 to	$6.35	$3.00 to	$5.35	$4.75 to	$6.75
February	3.50	5.75	5.00	6.75	3.25	6.00	5.00	7.00
March	3.50	6.10	5.00	7.00	3.25	6.25	5.00	7.10
April	3.50	6.10	4.75	7.25	3.25	6.25	4.75	7.35
May	3.50	6.00	4.75	7.00	3.50	6.15	5.00	7.15
June	3.25	5.25	5.00	6.25	3.00	5.60	4.00	6.00
July	3.00	4.60	4.00	5.50	3.00	4.70	4.00	5.10
August	3.00	4.60	4.00	5.35	3.00	4.50	4.00	5.85
September	2.50	4.00	4.00	5.25	2.25	4.10	4.00	5.35
October	2.00	4.00	4.00	5.35	2.00	4.25	3.75	5.85
November	2.00	4.25	3.75	5.00	2.00	4.15	3.50	5.15
December	2.25	4.35	3.50	5.50	2.00	4.30	3.50	5.55

Range and average price of horses at Chicago and Omaha, 1900.

CHICAGO.

Month.	Draft horses.	Carriage teams.	Drivers.	General use.	Bussers and trammers.	Saddlers.	Southern horses.
January	$145.00	$400.00	$125.00	$105.00	$115.00	$140.00	$50.00
February	155.00	420.00	130.00	110.00	120.00	145.00	50.00
March	157.50	440.00	135.00	110.00	120.00	150.00	55.00
April	160.00	460.00	140.00	115.00	120.00	155.00	57.50
May	155.00	450.00	150.00	110.00	120.00	170.00	52.50
June	145.00	430.00	145.00	105.00	118.00	165.00	50.00
July	145.00	420.00	140.05	105.00	115.00	160.00	50.00
August	150.00	400.00	140.00	105.00	112.00	155.00	45.00
September	150.00	375.00	135.00	100.00	112.00	145.00	50.00
October	155.00	350.00	135.00	95.00	110.00	140.00	55.00
November	150.00	375.00	137.50	90.00	105.00	135.00	55.00
December	155.00	385.00	140.00	90.00	100.00	130.00	55.00

OMAHA.

Month.	Draft horses.		Carriage teams.		Drivers.		General use.		Chunks.		Western horses.		Southern horses.	
January	$75 to	$135	$200 to	$300	$95 to	$225	$55 to	$85	$65 to	$90	$10 to	$20	$20 to	$45
February	80	150	200	300	95	225	55	90	65	100	10	20	20	50
March	90	165	200	300	95	225	55	90	65	100	10	20	20	50
April	90	175	200	300	95	225	60	100	65	110	10	20	20	50
May	100	150	300	450	90	325	65	105	75	115	12½	22½	20	45
June	90	140	300	450	90	325	40	65	65	100	12½	25	15	45
July	90	140	200	325	75	200	40	60	60	100	15	27½	15	45
August	90	140	210	420	75	220	40	60	60	100	17½	30	15	45
September	90	140	215	360	85	175	40	60	60	100	20	40	15	45
October	100	160	175	435	90	215	40	65	65	110	30	77½	20	45
November	90	150	230	370	90	325	40	60	65	100	12½	45	20	50
December	100	160	200	375	90	300	35	60	60	100	12½	40	20	55

Table showing average weight of hogs placed upon the market in 1899 and 1900.

	1899.	1900.
CHICAGO.	*Pounds.*	*Pounds.*
Average weight for year	237	233
KANSAS CITY.		
January	216	230
February	207	218
March	208	210
April	209	207
May	213	213
June	209	210
July	211	206
August	210	219
September	211	214
October	215	213
November	230	216
December	222	218
Average weight for year	213	215
OMAHA.		
January	262	257
February	245	237
March	247	243
April	247	236
May	251	239
June	250	239
July	248	234
August	246	240
September	256	249
October	259	245
November	270	253
December	268	252
Average weight for year	254	244
SIOUX CITY.		
January	283	254
February	257	244
March	260	243
April	263	244
May	263	243
June	264	244
July	260	242
August	260	257
September	275	267
October	291	271
November	296	280
December	280	266
Average weight for year	271	255
DENVER.		
January	238	229
February	235	218
March	235	204
April	232	214
May	247	216
June	225	211
July	214	212
August	229	221
September	239	234
October	236	227
November	247	226
December	243	225
Average weight for year	235	220
ST. JOSEPH.		
January	239	241
February	226	234
March	231	233
April	238	233
May	241	235
June	241	233
July	238	235
August	238	236
September	243	242
October	....	....
November	258	211
December	248	235
Average weight for year	240	236

PRODUCTION OF WOOL IN THE UNITED STATES IN 1900.

The table herewith is an estimate made by the National Association of Wool Manufacturers of the amount of wool produced in the several States and Territories in 1900. The estimate is based upon the number of sheep, as reported by the Division of Statistics of this Department. The association states that the average weight of the fleeces in the States and the percentage of shrinkage have been ascertained by voluminous correspondence with wool growers, wool dealers, wool manufacturers, State and county officials, etc., in all sections of the country.

The total product of wool in 1900 was 288,636,621 pounds, being 16,445,291 pounds greater than in 1899. It is estimated that the number of sheep has increased 9.1 per cent over 1899.

Wool clip of the United States, 1900.

State or Territory.	Number of sheep April 1.	Average weight of fleece.	Shrinkage.	Wool washed and unwashed.	Scoured wool.
		Pounds.	*Per cent.*	*Pounds.*	*Pounds.*
Maine	247,168	6	40	1,483,008	889,805
New Hampshire	76,383	6.50	55	496,490	223,421
Vermont	164,858	6.75	56	1,112,792	489,629
Massachusetts	39,632	6	48	237,792	123,652
Rhode Island	10,364	5.50	42	57,002	33,062
Connecticut	31,204	5.50	41	171,622	101,257
New York	819,088	6	50	4,914,528	2,457,264
New Jersey	41,654	5	47	208,270	110,384
Pennsylvania	777,677	6	50	4,666,062	2,333,031
Delaware	12,239	5	46	61,195	33,046
Maryland	133,341	5	47	666,705	353,354
Virginia	358,072	5	42	1,790,360	1,038,409
North Carolina	223,497	5	43	1,117,485	636,967
South Carolina	56,258	5	44	281,290	157,523
Georgia	271,534	4	40	1,086,136	651,682
Florida	70,064	4	42	280,256	162,549
Alabama	160,632	4	40	642,528	395,517
Mississippi	204,745	4	41	818,980	483,199
Louisiana	105,621	4.50	50	475,295	237,648
Texas	2,317,636	6.25	70	14,485,225	4,345,567
Arkansas	103,836	4.25	40	441,303	264,782
Tennessee	235,875	4.25	40	1,002,469	601,481
West Virginia	401,632	5.50	47	2,208,976	1,170,757
Kentucky	514,643	5.25	38	2,701,876	1,675,163
Ohio	2,754,499	5.75	51	15,838,369	7,760,800
Michigan	1,340,456	6.70	52	8,981,055	4,310,906
Indiana	647,399	6.50	55	4,250,094	2,337,552

Wool clip of the United States, 1900—Continued.

State or Territory.	Number of sheep April 1.	Average weight of fleece.	Shrinkage.	Wool washed and unwashed.	Scoured wool.
		Pounds.	*Per cent.*	*Pounds.*	*Pounds.*
Illinois	616,037	6.50	60	4,004,241	2,002,121
Wisconsin	726,040	6.50	51	4,719,260	2,312,437
Minnesota	409,157	6.75	55	2,761,809	1,242,814
Iowa	586,644	6.50	55	3,813,186	1,715,934
Missouri	570,128	6	50	3,420,768	1,710,384
Kansas	270,716	8	67	2,165,728	714,690
Nebraska	315,937	7.75	65	2,448,462	856,962
South Dakota	372,717	6.50	60	2,422,661	969,064
North Dakota	362,512	6.50	60	2,356,328	924,531
Montana	3,717,160	7	63	26,020,120	9,627,444
Wyoming	2,780,546	7.75	67	21,549,231	7,111,246
Colorado	2,128,508	6.25	67	13,303,175	4,390,048
New Mexico	3,786,688	4.25	54	16,093,424	7,402,975
Arizona	1,003,942	7.50	72	7,529,565	2,108,278
Utah	2,261,917	6.25	65	14,136,981	4,947,943
Nevada	612,387	7.50	69	4,592,903	1,424,400
Idaho	2,576,240	7.50	68	19,321,800	6,182,976
Washington	759,399	8.50	73	6,454,892	1,742,821
Oregon	2,351,274	8	70	18,810,192	5,643,058
California	1,907,430	7	66	13,352,010	4,539,683
Oklahoma	32,432	6.75	65	218,916	76,621
Total	40,267,818	6.01	53.5	259,972,815	101,024,837
Pulled wool	....	....	....	28,663,806	17,198,283
Total product, 1900	....	....	....	288,636,621	118,223,120

WORLD'S WOOL PRODUCTION IN 1900.

[Estimated by the National Association of Wool Manufacturers.]

	Pounds.	Pounds.
Europe:		
Great Britain and Ireland	[1]140,232,392	
Russia, including Poland	361,100,000	
France	103,610,000	
Spain	102,600,000	
Germany	49,590,000	
Austria-Hungary	64,300,000	
Italy	[2]21,451,000	
Portugal	13,410,000	
Sweden and Norway	8,200,000	
Turkey and Balkan Peninsula	67,500,000	
All other Europe	14,000,000	
		945,993,392
North America:		
United States	[3]288,636,621	
British Provinces	12,000,000	
Mexico	5,000,000	
		305,636,621
South America:		
Argentina	370,000,000	
Chile	7,500,000	
Brazil	1,500,000	
Uruguay	96,000,000	
Venezuela	15,000,000	
All other	20,000,000	
		510,000,000
Central America and West Indies		5,000,000
Asia:		
Russia	60,000,000	
British India	85,000,000	
Asiatic Turkey	33,000,000	
Central Asia	46,000,000	
China	35,000,000	
All other	15,000,000	
		274,000,000
Australasia		510,000,000
Africa:		
Algeria and Tunis	30,425,000	
Egypt	3,000,000	
Cape Colony, Natal, and Orange Free State	100,000,000	
All other	1,000,000	
		134,425,000
Oceania		50,000
Total		2,685,105,013

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[1] Great Britain and Ireland, product of 1899.

[2] Fleece washed.

[3] Washed and unwashed.

RULES AND REGULATIONS OF THE BUREAU OF ANIMAL INDUSTRY, ISSUED IN 1900.

[B. A. I. ORDER No. 57.—AMENDMENT TO B. A. I. ORDER No. 49.]

REGULATIONS CONCERNING CATTLE TRANSPORTATION.

Feeding Stations at Fort Worth and Baird, Tex.; Bakersfield, Cal., and Salisbury, N. C.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., January 20, 1900.

It is hereby ordered, That cattle originating outside, north, east, and west of the quarantine line as defined in Bureau of Animal Industry Order No. 49 (December 16, 1899), or amendments thereto, and which are to be transported by rail through the quarantined district, may be unloaded for rest, feed, and water into uninfected pens set apart for such cattle at Union Stock Yards, Fort Worth and Baird, Tex.; Bakersfield, Cal., and at Salisbury, N. C., providing the cattle are free from southern cattle ticks and have not been unloaded at any other place within the quarantined district. They may, after unloading into said pens, be reloaded into the same cars from which unloaded, or into other cleaned and disinfected cars, and reshipped as uninfected cattle.

All prior orders conflicting herewith are hereby revoked.

JAMES WILSON, *Secretary.*

[B. A. I. ORDER No. 58.—MODIFICATION OF B. A. I. ORDER No. 56.]

REGULATIONS FOR THE INSPECTION AND QUARANTINE OF HORSES, CATTLE, SHEEP, AND OTHER RUMINANTS, AND SWINE IMPORTED INTO THE UNITED STATES.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., January 27, 1900.

It is hereby ordered, That section *a* of rule 3 of the regulations for the inspection and quarantine of horses, cattle, sheep, and other ruminants, and swine, issued under date of December 28, 1899 (B. A. I. Order No. 56), be, and is, modified to read as follows:

(*a*) All horses imported into the United States from any part of the world, except as otherwise provided for the countries of North America, shall be required to pass a careful veterinary inspection at the port of entry.

JAMES WILSON, *Secretary.*

[B. A. I. ORDER No. 59.]

SPECIAL ORDER RELEASING CERTAIN CATTLE IN THE COUNTIES OF SACRAMENTO AND SOLANO, IN THE STATE OF CALIFORNIA, FROM THE RESTRICTIONS IMPOSED BY THE REGULATIONS OF DECEMBER 16, 1899 (B. A. I. ORDER NO. 49), AND MODIFICATIONS THEREOF, CONCERNING CATTLE TRANSPORTATION.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., February 26, 1900.

It is hereby ordered, That cattle now in the counties of Sacramento and Solano, in the State of California, may be moved to points in the State of California outside of the quarantined district as modified and described in the order of December 19, 1899

(B. A. I. Order No. 55), provided they have first been inspected and passed by an inspector of this Department or by the State veterinarian of that State and are accompanied by a certificate of inspection and are not exposed after such inspection to infectious cattle or premises and are immediately removed to point of destination.

It is further ordered, That no cattle from the quarantine district described by the order of December 16, 1899 (B. A. I. Order No. 49), as modified, shall be moved into the counties of Sacramento and Solano.

This order to remain in force until December 31, 1900, unless otherwise ordered.

JAMES WILSON, *Secretary*.

[B. A. I. ORDER NO. 60.—SUPPLEMENTARY TO B. A. I. ORDER NO. 49.]

SPECIAL ORDER PROVIDING FOR RETURN TO NONINFECTED DISTRICT OF CATTLE EXHIBITED AT STATE FAIR AT RALEIGH, N. C.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., April 6, 1900.

It is hereby ordered, That cattle from above the quarantine line, and which have been shipped directly from the noninfected district to the fair grounds at Raleigh, N. C., for exhibition at the State Fair of 1900, and which are returned without having been unloaded elsewhere, be permitted to return as uninfected cattle, providing they are accompanied by a certificate of the veterinarian of the North Carolina Department of Agriculture showing that they have had no opportunity to become infected with the tick (*Boophilus bovis*) while at said grounds.

JAMES WILSON, *Secretary*.

[B. A. I. ORDER NO. 61.]

ORDER CONCERNING THE EXPORTATION OF CATTLE AND SHEEP IN VESSELS CARRYING HIDES FROM FOREIGN COUNTRIES.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., April 23, 1900.

In consequence of the prevalence of certain contagious and infectious diseases among the cattle of Europe and South America, and in order to prevent the possibility of the infection of cattle and sheep exported from the United States through the medium of imported hides, *it is hereby ordered*, That no cattle or sheep be permitted to be loaded in vessels that have carried foreign hides from the countries mentioned in the spaces reserved for cattle and sheep.

And it is further ordered, That the cattle and sheep space on all vessels that have heretofore carried foreign hides in any part of the vessel shall be thoroughly cleaned and disinfected before cattle or sheep shall be allowed therein for exportation.

JAMES WILSON, *Secretary*.

[B. A. I. ORDER NO. 62.—AMENDMENT TO B. A. I. ORDER NO. 49.]

REGULATIONS CONCERNING CATTLE TRANSPORTATION.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., May 11, 1900.

Conforming to the request of the authorities of the State of Texas, and in order that protection be given to cattle in certain counties of that State which are uninfected with the disease known as splenetic, or Southern, fever,

It is hereby ordered, That no cattle originating in the quarantined district as described in B. A. I. Order No. 49, as modified, shall be moved or allowed to move into the counties of Throckmorton, Baylor, and Archer.

And it is further ordered, That no cattle shall be moved or allowed to move from the counties of Throckmorton, Baylor, and Archer to any of that territory in the State of

Texas lying west and north of said counties, except after having been inspected and found free of infection by duly authorized inspectors of this Department, or of the State of Texas, and upon written permission by such officer.

No cattle from said counties shall be moved or allowed to move to any State or Territory outside of the quarantined district (except as provided for immediate slaughter), unless they have been duly inspected and passed and permit issued by inspectors of this Department, nor until permission has been obtained from the proper officials of the State or Territory to which destined.

This order to remain in force until otherwise ordered.

JAMES WILSON, *Secretary.*

[B. A. I. ORDER NO. 63—AMENDMENT TO B. A. I. ORDER NO. 49.]

REGULATIONS CONCERNING CATTLE TRANSPORTATION.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., May 16, 1900.

In order to prevent the introduction of contagion into the island of Porto Rico,

It is hereby ordered, That no cattle originating in the district of the United States infected with splenetic, or Southern, fever and quarantined by virtue of B. A. I. Order No. 49, as modified, shall be allowed shipment to that island until otherwise ordered.

J. H. BRIGHAM, *Acting Secretary*

[B. A. I. ORDER NO. 64—AMENDMENT TO B. A. I. ORDER NO. 56.]

REGULATIONS FOR THE INSPECTION AND QUARANTINE OF HORSES, CATTLE, SHEEP, AND OTHER RUMINANTS, AND SWINE IMPORTED INTO THE UNITED STATES.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., June 1, 1900.

It is hereby ordered, That rule 1 of the regulations for the inspection and quarantine of horses, cattle, sheep, and other ruminants, and swine, issued under date of December 28, 1899 (B. A. I. Order No. 56), be, and is, amended by the addition of San Francisco, Cal., and Van Buren and Fort Fairfield, Me., as quarantine stations.

It is further ordered, That section *a*, rule 6, of these regulations be modified to provide for the admission of horses into the Seven Islands district, in the port of Houlton, Me., for lumbering purposes without inspection.

JAMES WILSON, *Secretary.*

[B. A. I. ORDER NO. 65.]

SPECIAL ORDER PROVIDING FOR THE IMPORTATION OF CANADIAN CATTLE FOR EXHIBITION PURPOSES AT THE PAN-AMERICAN EXPOSITION, BUFFALO, N. Y.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., June 15, 1900.

It is hereby ordered, That Canadian cattle may be imported into the United States for exhibition purposes at the Pan-American Exposition to be held from May 1 to November 1, 1901, at Buffalo, N. Y., without being subjected to the tuberculin test, provided they are accompanied by a certificate issued by a Canadian official veterinarian, stating that such cattle are free from contagious and infectious diseases, and provided further, that they are returned immediately to Canada at the close of the Exposition.

All cattle, sheep, and swine intended for this Exposition must be shipped directly to the Exposition grounds and not unloaded in any public stock yards.

J. H. BRIGHAM, *Acting Secretary.*

[B. A. I. ORDER NO. 66—AMENDMENT TO B. A. I. ORDER NO. 49.]

REGULATIONS CONCERNING CATTLE TRANSPORTATION.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., July 13, 1900.

In consequence of the existence of Texas, or splenetic, fever among cattle in Chautauqua County, in the State of Kansas,

It is hereby ordered, That no cattle which have been in said Chautauqua County, Kans., at any time since April 1, 1900, or which may be taken to said county during the continuance of this order shall be removed from said county and shipped to any other State or Territory except for immediate slaughter and according to the regulations of this Department as specified in B. A. I. Order No. 49 for the movement of Southern cattle: *Provided, however*, That cattle which have been inspected and found free of disease by an officer of this Department and for which shipping permit has been granted by said officer, may be moved without restriction, unless exposed to infection en route.

This order to remain in force until November 1 next.

JAMES WILSON, *Secretary*,

[B. A. I. ORDER NO. 67.]

SPECIAL ORDER PROVIDING FOR THE IMPORTATION OF CANADIAN CATTLE, SHEEP, AND SWINE FOR EXHIBITION PURPOSES AT INTERNATIONAL LIVE-STOCK EXPOSITION, CHICAGO, ILL.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., July 13, 1900.

It is hereby ordered, That Canadian cattle may be imported into the United States for exhibition purposes at the International Live-Stock Exposition to be held from December 1 to December 8, 1900, at Chicago, Ill., without being subjected to the tuberculin test, provided they are accompanied by a certificate issued by a Canadian official veterinarian, stating that such cattle are free from contagious and infectious diseases, and provided further that they are returned immediately to Canada at the close of the Exposition.

All Canadian cattle, sheep, and swine intended for this Exposition must be shipped directly to the Exposition grounds and not unloaded in any public stock yards.

JAMES WILSON, *Secretary*.

[B. A. I. ORDER NO. 68—REVOKING B. A. I. ORDER NO. 63.]

REGULATIONS CONCERNING CATTLE TRANSPORTATION.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., August 13, 1900.

It is hereby ordered, That B. A. I. Order No. 63, dated May 16, 1900, prohibiting the shipment of cattle from certain portions of the United States to the island of Porto Rico, be, and the same is hereby, revoked, to take effect September 1, 1900.

JAMES WILSON, *Secretary*.

[B. A. I. Order No. 69—Supplemental to B. A. I. Orders Nos. 55 and 59.]

SPECIAL ORDER PROVIDING FOR EXHIBITION OF UNINFECTED CATTLE AT THE SAN FRANCISCO AND SAN MATEO AGRICULTURAL ASSOCIATION FAIR, TO BE HELD AT TANFORAN PARK, SAN MATEO COUNTY, AND AT THE CALIFORNIA STATE FAIR, TO BE HELD AT SACRAMENTO.

U. S. Department of Agriculture,
Office of the Secretary,
Washington, D. C., August 18, 1900.

It is hereby ordered, That cattle from above the quarantine line, as described in B. A. I. Order No. 55, as modified by Order No. 59, and which have been shipped directly from the uninfected district to either the fair grounds at Tanforan Park, San Mateo County, or to the fair grounds at Sacramento, for exhibition, and which are returned without having been unloaded elsewhere, be permitted to return as uninfected cattle, providing they are accompanied by a certificate of the State Veterinarian of California, showing that they had no opportunity to become infected with *Boophilus bovis* ticks while at said fair grounds.

It is further ordered, That uninfected cattle originating from below the quarantine line, as described in B. A. I. Order No. 55, may be exhibited at the State Fair to be held at Sacramento, providing they have first been inspected by the State Veterinarian of California and found to be free from contagious or infectious disease, and have been shipped directly to the fair grounds without exposure to infection. Such cattle, however, must be returned to their points of origin directly alter the close of the fair.

James Wilson, *Secretary.*

[B. A. I. Order No. 70—Supplementary to B. A. I. Order No. 49.]

SPECIAL ORDER PROVIDING FOR RETURN TO NONINFECTED DISTRICT OF CATTLE EXHIBITED AT THE SOUTHERN INTERSTATE FAIR AT ATLANTA, GA.

U. S. Department of Agriculture,
Office of the Secretary,
Washington, D. C., August 20, 1900.

It is hereby ordered, That cattle from above the quarantine line, and which have been shipped directly from the noninfected district to the fair grounds at Atlanta, Ga., for exhibition at the Southern Interstate Fair of 1900, and which are returned without having been unloaded elsewhere, be permitted to return as uninfected cattle, providing they are accompanied by a certificate of the veterinarian of the Southern Interstate Fair Association (who has been approved by the governor of the State), showing that they have had no opportunity to become infected with the tick (*Boophilus bovis*) while at said grounds.

James Wilson, *Secretary.*

[B. A. I. Order No. 71—Revoking B. A. I. Order No. 66.]

REGULATIONS CONCERNING CATTLE TRANSPORTATION.

U. S. Department of Agriculture,
Office of the Secretary,
Washington, D. C., August 23, 1900.

It is hereby ordered, That B. A. I. Order No. 66, dated July 13, 1900, regulating the interstate shipment of cattle from Chautauqua County, Kans., be, and the same is hereby, revoked, to take effect this day.

James Wilson, *Secretary.*

[B. A. I. ORDER No. 72—AMENDMENT TO B. A. I. ORDERS NOS. 49 AND 51.]

REGULATIONS CONCERNING CATTLE TRANSPORTATION.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., August 29, 1900.

In consequence of infectious cattle having been driven into Greer County, in violation of B. A. I. Orders 49 and 51, and of infection being present among cattle in Dewey County ("D" Co.), Okla., and to prevent the spread of such infection—

It is hereby ordered, That no cattle which are now in said counties, or which may be taken to said counties during the continuance of this order, shall be removed from said counties and shipped to any State or Territory, except for immediate slaughter, and according to the regulations of this Department as specified in B. A. I. Order No. 49 for the movement of Southern cattle: *Provided, however*, That cattle of said counties which have been inspected and found free of disease by an officer of this Department, and for which shipping permit has been granted by said officer, may be moved without restriction, unless exposed to infection en route.

This order to remain in force until November 1 next.

JAMES WILSON, *Secretary.*

[B. A. I. ORDER No. 73—SUPPLEMENTAL TO B. A. I. ORDERS NOS. 55 AND 59.]

SPECIAL ORDER PROVIDING FOR EXHIBITION OF UNINFECTED CATTLE AT THE GOLDEN GATE FAIR, TO BE HELD AT OAKLAND, CAL.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., September 8, 1900.

It is hereby ordered, That cattle from above the quarantine line, as described in B. A. I. Order No. 55, as modified by Order No. 59, and which have been shipped directly from the uninfected district to the fair grounds at Oakland for exhibition, and which are returned without having been unloaded elsewhere, be permitted to return as uninfected cattle, providing they are accompanied by a certificate of the State veterinarian of California, showing that they had no opportunity to become infected with *Boophilus bovis* ticks while at said fair grounds.

JAMES WILSON, *Secretary.*

[B. A. I. ORDER No. 74—AMENDMENT TO B. A. I. ORDERS NOS. 49 AND 51.]

REGULATIONS CONCERNING CATTLE TRANSPORTATION.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., September 17, 1900.

In consequence of infection being present among cattle in Day County, Okla., and to prevent the spread of such infection—

It is hereby ordered, That no cattle which are now in said county, or which may be taken to said county during the continuance of this order, shall be removed from said county and shipped to any State or Territory, except for immediate slaughter, and according to the regulations of this Department, as specified in B. A. I. Order No. 49 for the movement of Southern cattle: *Provided, however*, That cattle of said county which have been inspected and found free of disease by an officer of this Department and for which shipping permit has been granted by said officer, may be moved without restriction, unless exposed to infection en route.

This order to remain in force until November 1 next.

J. H. BRIGHAM, *Acting Secretary.*

[B. A. I. ORDER No. 75—AMENDMENT TO B. A. I. ORDERS NOS. 49 AND 50.]

REGULATIONS CONCERNING CATTLE TRANSPORTATION.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., September 26, 1900.

In consequence of splenetic, or Southern, fever infection being present among cattle in Haskell and Jones counties, Tex., and to prevent the spread of infection—

It is hereby ordered, That no cattle which are now in said counties, or which may be taken to said counties during the continuance of this order, shall be removed from said counties and shipped to any State or Territory, except for immediate slaughter and according to the regulations of this Department as specified in B. A. I. Order No. 49 for the movement of Southern cattle: *Provided, however,* That cattle of said counties which have been inspected and found free of disease by an officer of this Department, and for which shipping permit has been granted by said officer, may be moved without restriction, unless exposed to infection en route.

This order to remain in force until otherwise ordered.

J. H. BRIGHAM, *Acting Secretary.*

[B. A. I. ORDER NO. 76—AMENDMENT TO B. A. I. ORDER NO. 49.]

REGULATIONS CONCERNING CATTLE TRANSPORTATION.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., October 9, 1900.

It is hereby ordered, That section 3 of B. A. I. Order No. 49, providing for the movement of cattle from the quarantined district described by said order and amendments thereto, from November 1 to December 31, inclusive, be amended as follows:

From November 1 to December 31, inclusive, cattle from said area destined to points within the States of Kansas and Missouri and the Territories of Arizona and New Mexico, and to points in the States of Texas and Tennessee and the Territory of Oklahoma outside of said quarantined district may be moved thereto upon authorization procured from the authorities of the State or Territory to which destined. All cattle from said quarantined district destined to points outside of the States and Territories above named may be shipped without inspection between November 1 and December 31, inclusive, and without restriction other than may be enforced by local regulations at point of destination.

And it is further ordered, That all stock pens which have been reserved for the use of cattle from the quarantined district, prior to November 1 next, shall not be used for receiving or storing cattle from the quarantined district which have been inspected and passed, nor for cattle originating outside of the quarantined district, except when such cattle are intended for immediate slaughter.

JAMES WILSON, *Secretary.*

[B. A. I. ORDER NO. 77—AMENDMENT TO B. A. I. ORDER NO. 56.]

REGULATIONS FOR THE INSPECTION AND QUARANTINE OF HORSES, CATTLE, SHEEP, AND OTHER RUMINANTS, AND SWINE, IMPORTED INTO THE UNITED STATES.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., October 20, 1900.

It is hereby ordered, That rule 1 of the regulations for the inspection and quarantine of horses, neat cattle, sheep, and other ruminants, and swine imported into the United States, issued under date of December 28, 1899 (B. A. I. Order No. 56), be, and is hereby, amended by the addition of Hogansburg, N. Y. (port of Plattsburg, N. Y.), and Massena, N. Y. (port of Ogdensburg, N. Y.), as animal quarantine stations for the inspection and quarantine of animals imported into the United States.

JAMES WILSON, *Secretary.*

[B. A. I. ORDER NO. 78—AMENDMENT TO B. A. I. ORDER NO. 33.]

REGULATIONS FOR THE INSPECTION OF LIVE STOCK AND THEIR PRODUCTS.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., October 22, 1900.

It is hereby ordered, That section 9 (a) of the regulations for the inspection of live stock and their products, issued under date of March 15, 1899 (B. A. I. Order No. 33), be, and is hereby, amended as follows: That seals upon cars in which meat is shipped to official abattoirs may be broken when it is necessary to unload such cars during the absence of the inspector or his assistant, provided the seals and tags which are removed, together with a memorandum containing the initials, number, and contents of such car (pieces and weight), be furnished by the owners or managers of the abattoir receiving the meat.

WILLIS L. MOORE, *Acting Secretary.*

[B. A. I. ORDER NO. 79—AMENDMENT to B. A. I. ORDER NO. 56.]

REGULATIONS FOR THE INSPECTION AND QUARANTINE OF HORSES, CATTLE, SHEEP, AND OTHER RUMINANTS, AND SWINE IMPORTED INTO THE UNITED STATES.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., November 10, 1900.

It is hereby ordered, That rule 5 of the regulations for the inspection and quarantine of horses, cattle, sheep, and other ruminants, and swine, issued under date of December 28, 1899, B. A. I. Order No. 56, be, and is hereby, amended to read as follows: All cattle over 6 months old imported into the United States after December 1, 1900, which are subject to quarantine, and except as otherwise provided, shall be tested with tuberculin by an inspector of this Department, stationed in Great Britain, or after arrival at the animal quarantine station. All cattle so tested and which show a reaction shall be prohibited from entry into the United States or be disposed of as provided in section 10 of above regulations.

For cattle imported by way of Canada certificate of tuberculin tests made by the Canadian superintendent of quarantine during the period of detention will be accepted.

It is further ordered, That rule 6 (paragraph *c*) be, and is hereby, amended as follows: All milch cows, and cattle over 6 months old for breeding purposes, shall be tested with tuberculin by an inspector of this Department, and all cattle so tested which show a reaction shall be prohibited from entry into the United States.

JAMES WILSON, *Secretary.*

Those desiring animals tested abroad should address Dr. Tooie A. Geddes, care of U. S. Consul-General's Office, London. Those desiring cattle tested in Canada should address Dr. E. L. Volgenau, Live Stock Exchange Building, East Buffalo, N. Y.

Permits as required by rule 9 of B. A. I. Order No. 56 for cattle and other animals must be obtained as heretofore.

[B. A. I. ORDER NO. 80.]

REGULATIONS CONCERNING CATTLE TRANSPORTATION.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., December 10, 1900.

To managers and agents of railroads and transportation companies of the United States, stockmen, and others:

In accordance with section 7 of the act of Congress approved May 29, 1884, entitled "An act for the establishment of a Bureau of Animal Industry, to prevent the exportation of diseased cattle, and to provide means for the suppression and extirpation of pleuropneumonia and other contagious diseases among domestic animals," and of the act of Congress approved May 25, 1900, making appropriation for the Department of Agriculture for the fiscal year ending June 30, 1901, you are hereby notified that a contagious and infectious disease known as splenetic, Southern, or Texas, fever exists among cattle in the following described area:

1. All that country lying south, or below, a line beginning at the northwest corner of the State of California; thence east, south, and southeasterly along the boundary line of said State of California to the southeastern corner of said State; thence southerly along the western boundary line of Arizona to the southwest corner of Arizona; thence along the southern boundary lines of Arizona and New Mexico to the southeastern corner of New Mexico; thence northerly along the eastern boundary of New Mexico to the southern line of the State of Colorado; thence along the southern boundary lines of Colorado and Kansas to the southeastern corner of Kansas; thence southerly along the western boundary line of Missouri to the southwestern corner of Missouri; thence easterly along the southern boundary line of Missouri to the western boundary line of Dunklin County; thence southerly along the said western boundary to the southwestern corner of Dunklin County; thence easterly along the southern boundary line of Missouri to the Mississippi River; thence northerly along the Mississippi River to the northern boundary line of Tennessee at the northwest corner of Lake County; thence easterly along said boundary line to the northeast corner of Henry County; thence in a northerly direction along the boundary of Tennessee to the northwest corner of Stewart County; thence in an easterly direction along the northern boundary of Tennessee to the southwestern corner of Virginia; thence northeasterly along the western boundary line of Virginia to the northernmost point of Virginia; thence southerly along the eastern boundary line of Virginia to the northeast corner of Virginia where it joins the southeastern corner of Maryland at the Atlantic Ocean.

2. Whenever any State or Territory located above or below said quarantine line, as above designated, shall duly establish a different quarantine line, and obtain the necessary legislation to enforce said last-mentioned line strictly and completely within the boundaries of said State or Territory, and said last above-mentioned line and the measures taken to enforce it are satisfactory to the Secretary of Agriculture, he may, by a special order, temporarily adopt said State or Territorial line.

Said adoption will apply only to that portion of said line specified, and may cease at any time the Secretary may deem it best for the interest involved, and in no instance shall said modification exist longer than the period specified in said special order; and at the expiration of such time, said quarantine line shall revert without further order to the line first above described.

Whenever any State or Territory shall establish a quarantine line, for above purposes differently located from the above-described line, and shall obtain by legislation the necessary laws to enforce the same completely and strictly, and shall desire a modification of the Federal quarantine line to agree with such State or Territorial line, the proper authorities of such State or Territory shall forward to the Secretary of Agriculture a true map or description of such line and a copy of the laws for enforcement of same, duly authenticated and certified.

3. From the 1st day of January, 1901, no cattle are to be transported from said area south, or below, said Federal quarantine line above described to any portion of the United States above—north, east, or west of the above described line, except as hereinafter provided.

4. Cattle from said area may be transported by rail or boat for immediate slaughter, and when so transported the following regulations must be observed:

(*a*) When any cattle in course of transportation from said area are unloaded above—north, east, or west of—this line to be fed or watered, or for other purposes, said cattle shall be placed in pens or yards set apart for infected cattle, and no other cattle shall be admitted thereto.

(*b*) On unloading said cattle at their points of destination, chutes, alleyways, and pens, sufficiently isolated, shall be set apart to receive them, and no other cattle shall be admitted to said chutes, pens, and alleyways; and the regulations relating to the movement of cattle from said area, prescribed by the cattle sanitary officers of the State where unloaded, shall be carefully observed. The cars or boats that have carried said stock shall be cleansed and disinfected as soon as possible after unloading and before they are again used to transport, store, or shelter animals or merchandise.

(*c*) All cars carrying cattle from said area shall bear printed placards, the letters of which shall be plain and not less than 1½ inches in height, to be affixed by the railroad company hauling the same, stating that said cars contain Southern cattle; and each of the waybills, conductor's manifests, and bills of lading of said shipments by cars or boats shall have a note plainly written or stamped upon its face with a similar statement. Whenever any cattle have come from said area and shall be reshipped from any point at which they have been unloaded to other points of destination, the cars carrying said animals shall bear similar placards with like statements, and the waybills, conductor's manifests, or bills of lading be so stamped. At whatever point these cattle are unloaded, they must be placed in separate pens to which no other cattle shall be admitted.

(*d*) No boat having on board cattle from said district shall receive on board cattle from outside of said district. Cattle from said district shall not be received on board when destined to points outside of said district where proper facilities have not been provided for transferring the said cattle from the landing to the stock yards and slaughterhouses without passing over public highways, unless permission for such passing is first obtained from the local authorities.

(*e*) The cars and boats used to transport such animals, the chutes, alleyways, and pens used during transportation and at points of destination shall be disinfected in the following manner:

Remove all litter and manure. This litter and manure may be disinfected by mixing it with lime or saturating it with a 5 per cent solution of 100 per cent carbolic acid; or, if not disinfected, it may be stored where no cattle can come in contact with it during the period from February 1 to November 15 of each year.

Wash the cars and the feeding and watering troughs with water until clean.

Saturate the entire interior surface of the cars and the fencing, troughs, and chutes of the pens with a mixture made of 1½ pounds of lime and one-quarter pound of 100 per cent straw-colored carbolic acid to each gallon of water; or a solution made by dissolving 4 ounces of chloride of lime to each gallon of water may be used; or disinfect the cars with a jet of steam under a pressure of not less than 50 pounds to the square inch.

5. Cattle from the Republic of Mexico may be admitted into the United States, after inspection according to law, as follows:

Cattle free from splenetic, or Texas, fever and from contact therewith during the three months preceding such inspection, and which have been grazed in a locality free from infection of such fever, may be admitted into any part of the United States. If destined to points in the noninfected area, a special permit must be obtained from an inspector of the Bureau of Animal Industry, said permit being issued according to the regulations of said Bureau. The cattle for which said permit is issued must not be driven through the infected area nor be unloaded in any part thereof, except at such a point as may be duly designated by an order issued by this Department; if shipped in infected cars or unloaded in the infected area, except as above stated, they will be subject to the regulations concerning infectious cattle.

6. Notice is hereby given that cattle infested with the *Boophilus bovis*, or Southern cattle tick, disseminate the contagion of splenetic, Southern, or Texas, fever; therefore cattle originating outside of the district described by this order or amendments thereof, and which are infested with the *Boophilus bovis* ticks, shall be considered as infectious cattle and shall be subject to the rules and regulations governing the movement of Southern cattle.

7. Stock-yard companies receiving cattle infested with said ticks shall place such cattle in the pens set aside for the use of Southern cattle, and transportation companies are required to clean and disinfect all cars and boats which have contained the same, according to the requirements of this Department.

8. Inspectors are instructed to see that disinfection is properly done, and to report instances of improper disinfection. It is expected that transportation and stock-yard companies will promptly put into operation the above methods.

All prior orders conflicting herewith are hereby revoked.

JAMES WILSON, *Secretary*.

[B. A. I. ORDER No. 81.]

SPECIAL ORDER MODIFYING QUARANTINE LINE FOR THE STATE OF TEXAS. (1901.)

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., December 14, 1900.

In accordance with the regulations concerning cattle transportation issued by this Department, the State of Texas has agreed to establish and to cooperate in the enforcement of a quarantine line located as follows:

Beginning at the intersection of the southern boundary of New Mexico with the international boundary line at the Rio Grande River; thence southeasterly along the said international boundary line to the southwest corner of the county of Pecos; thence following the western boundary of Pecos County to the southeast corner of

Reeves County; thence following the boundary line between the counties of Pecos and Reeves to the Pecos River; thence southeasterly, following the Pecos River, to the northwest corner of Crockett County; thence east along the northern boundary of Crockett and Schleicher counties to the southeastern corner of Irion County; thence north along the eastern boundary of Irion County to the northeast corner of said county; thence north to the southern boundary of Coke County; thence west to the southwest corner of Coke County; thence north along the western boundary of Coke County to the southern boundary of Mitchell County; thence east to the southeastern corner of Mitchell County; thence north along the eastern boundary of Mitchell County to the northeast corner of said county; thence east along the southern boundaries of Fisher and Jones counties to the southeast corner of Jones County; thence north along the eastern boundary of Jones County to the northeast corner of said county; thence east along the southern boundary of Haskell County to the southeast corner of said county; thence north along the western boundary lines of Throckmorton and Baylor counties to the northwest corner of Baylor County; thence east along the southern boundary of Wilbarger County to the southeast corner of said county; thence north along the eastern boundary of Wilbarger County to the Red River; thence continuing in a northwesterly direction along the course of said river and the northern boundary of Texas to the southeast corner of Greer County.

And whereas said quarantine line, as above set forth, is satisfactory to this Department, and legislation has been enacted by the State of Texas to enforce said quarantine line, therefore the above quarantine line is adopted for the State of Texas by this Department for the period beginning on January 1, 1901, and ending December 31, 1901, in lieu of the quarantine line described in the order of December 10, 1900, for said area, unless otherwise ordered.

JAMES WILSON, *Secretary.*

[B. A. I. ORDER NO. 82.]

SPECIAL ORDER MODIFYING QUARANTINE LINE FOR THE TERRITORY OF OKLAHOMA. (1901.)

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., December 14, 1900.

In accordance with the regulations concerning cattle transportation issued by this Department, the Territory of Oklahoma has agreed to establish and cooperate in the enforcement of a quarantine line located as follows:

Beginning on the Red River at the southeastern corner of the county of Greer; thence northerly, following the course of the North Fork of the Red River to its intersection with the southern boundary line of Roger Mills County, along the western boundary lines of the Apache, Comanche, and Kiowa Indian reservations; thence east along the southern boundary lines of Roger Mills and Washita counties to the intersection with the boundary line of the Wichita Indian Reservation on the Washita River; thence north along the western boundary line of said reservation to its northwest corner, at its intersection with the Canadian River, in the county of G; thence in a southeasterly direction along the course of said river and the northern boundary of the Wichita Indian Reservation to the northeast corner of said reservation; thence easterly along the southern boundary of Canadian County to the southeast corner of said county; thence north along the eastern boundary lines of Canadian and Kingfisher counties to the northeastern corner of Kingfisher County; thence east along the southern boundary of Garfield County to the southeast corner of said county; thence north along the eastern boundary of Garfield County to the northeast corner of said county; thence east along the southern boundary line of Kay County to the west line of the Ponca Indian Reservation; thence north along the west line of said reservation to the northwest corner of said reservation; thence east along the northern boundary of the Ponca Indian Reservation to the Arkansas River; thence in a northerly direction, following the course of the said river to its intersection with the thirty-seventh parallel of north latitude, at the southern boundary line of Kansas.

And whereas said quarantine line, as above set forth, is satisfactory to this Department, and legislation has been enacted by the Territory of Oklahoma to enforce said quarantine line, therefore the above quarantine line is adopted for the Territory of Oklahoma by this Department for the period beginning on January 1, 1901, and ending December 31, 1901, in lieu of the quarantine line described in the order of December 10, 1900, for said area, unless otherwise ordered.

JAMES WILSON, *Secretary.*

[B. A. I. ORDER NO. 83.]

SPECIAL ORDER MODIFYING QUARANTINE LINE FOR THE STATE OF VIRGINIA. (1901.)

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., December 14, 1900.

In accordance with the regulations concerning cattle transportation issued by this Department, the State of Virginia has agreed to establish and to cooperate in the enforcement of a quarantine line located as follows:

Beginning at the boundary line of Virginia at its southwestern corner (Lee County); thence east along the southern boundary of Virginia to the southwestern corner of Patrick County; thence northerly along the western boundaries of Patrick and Franklin counties to Daniels Run; thence easterly along Daniels Run and the Blackwater River to the Staunton River; thence in a southeasterly and northeasterly direction along the southern and eastern boundaries of Bedford County to the James River; thence following the James River to the southeastern corner of Charles City County; thence northerly and easterly along the western and northern boundaries of James City County to the western boundary of Gloucester County at the York River; thence southerly and northerly along the southern and eastern boundaries of Gloucester County to the northeastern corner of said county; thence easterly and southerly along the northern and eastern boundaries of Mathews County to the southeastern point of said county; thence south to the northern boundary of Elizabeth City County; thence westerly and northerly along the boundaries of Elizabeth City and Warwick counties to the James River; thence southeasterly along the course of the said river to the northwest corner of Norfolk County; thence south along the western boundary of said county to its intersection with the northern boundary of North Carolina; thence east along the southern boundaries of Norfolk and Princess Anne counties to the Atlantic Ocean.

And whereas said quarantine line, as above set forth, is satisfactory to this Department, and legislation has been enacted by the State of Virginia to enforce said quarantine line, therefore the above quarantine line is adopted for the State of Virginia by this Department for the period beginning on January 1, 1901, and ending December 31, 1901, in lieu of the quarantine line described in the order of December 10, 1900, for said area, unless otherwise ordered.

JAMES WILSON, *Secretary.*

[B. A. I. ORDER NO. 84.]

SPECIAL ORDER MODIFYING QUARANTINE LINE FOR THE STATE OF TENNESSEE. (1901.)

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., December 14, 1900.

In accordance with the regulations concerning cattle transportation issued by this Department, the State of Tennessee has agreed to establish and cooperate in the enforcement of a quarantine line located as follows:

Beginning on the Mississippi River at the southeast corner of the State of Missouri at the western boundary of Tennessee; thence southerly along the western boundaries of the counties of Dyer and Lauderdale to the southwest corner of Lauderdale County on the Mississippi River; thence easterly along the northern boundary of Tipton County to the northeast corner of said county; thence northerly and easterly along the western and northern boundaries of Haywood County to the northeast corner of said county; thence easterly along the northern boundary lines of Madison, Henderson, and Decatur counties to the northeast corner of Decatur County; thence south along the eastern boundary of Decatur County to the northwest corner of Wayne County; thence easterly along the northern boundary lines of Wayne and Lawrence counties to the northeastern corner of Lawrence County; thence south along the western boundary of Giles County to the southwestern corner of said county; thence east and north along the southern and eastern boundaries of said county to the Elk River; thence easterly along said river to the eastern boundary of Lincoln County; thence northerly along the eastern boundary of Lincoln County to Bedford County; thence easterly along the northern boundary of Moore County to the northeast corner of Moore County; thence north along the western boundary lines of

Coffee and Cannon counties to the northwest corner of Cannon County; thence easterly to the northeast corner of Cannon County; thence south to the intersection of the eastern boundary line of Cannon County with the boundary of Warren County; thence easterly and northerly along the northern boundary lines of Warren and White counties to Cumberland County; thence southerly, easterly, and northeasterly to the northern corner of Rhea County; thence southerly along the eastern boundary lines of Rhea and James counties to the northwest corner of Bradley County; thence northerly and southeasterly along the northern boundary lines of Bradley and Polk counties to the northeast corner of Polk County; thence south along the eastern boundary line of Polk County to the southeast corner thereof at the southwestern corner of North Carolina.

That portion of the quarantine line for the State of Virginia, described in the order of December 14, 1900 (B. A. I. Order No. 83), beginning at the southwestern corner of Virginia (Lee County) and extending east along the southern boundary line of Virginia to the southeastern corner of Washington County, is hereby suspended during the enforcement of the above line for the State of Tennessee.

And whereas, said quarantine line, as above set forth, is satisfactory to this Department, and legislation has been enacted by the State of Tennessee to enforce said quarantine line, therefore the above quarantine line is adopted for the State of Tennessee by this Department for the period beginning on January 1, 1901, and ending December 31, 1901, in lieu of the quarantine line described in the order of December 10, 1900, for said area, unless otherwise ordered.

JAMES WILSON, *Secretary.*

[B. A. I. ORDER NO. 85.]

SPECIAL ORDER MODIFYING QUARANTINE LINE FOR THE STATE OF NORTH CAROLINA. (1901.)

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., December 14, 1900.

In accordance with the regulations concerning cattle transportation, issued by this Department, the State of North Carolina has agreed to establish and to cooperate in the enforcement of a quarantine line located as follows:

Beginning at the southwest corner of the county of Cherokee; thence east along the southern boundary lines of the counties of Cherokee, Clay, Macon, Jackson, Transylvania, and Henderson, to the southeast corner of the county of Henderson; thence northerly along the eastern boundary line of Henderson County to the northeast corner thereof; thence westerly to the eastern boundary line of Buncombe County; thence northerly along the eastern boundary line of Buncombe County to the southern boundary line of Yancey County; thence northeasterly along the southern boundary line of Yancey County to the southern portion of Mitchell County; thence northeasterly along the southern and eastern boundary line of Mitchell County to the southern boundary line of Watauga County; thence easterly along the southern boundary line of Watauga County to the western boundary line of Wilkes County; thence following the western and northern boundary line of Wilkes County to the western portion of Surry County; thence northeasterly along the eastern boundary line of Alleghany County to its intersection with the northern boundary line of the State of North Carolina.

That portion of the quarantine line for the State of Virginia, described in the order of December 14, 1900 (B. A. I. Order No. 83), beginning at the southwestern corner of Grayson County and extending east along the southern boundary line of Virginia to the southeastern corner of said county, is hereby suspended during the enforcement of the above line for the State of North Carolina.

And whereas said quarantine line, as above set forth, is satisfactory to this Department, and legislation has been enacted by the State of North Carolina to enforce said quarantine line, therefore the above quarantine line is adopted for the State of North Carolina by this Department for the period beginning on January 1, 1901, and ending December 31, 1901, in lieu of the quarantine line described in the order of December 10, 1900, for said area, unless otherwise ordered.

JAMES WILSON, *Secretary.*

[B. A. I. Order No. 86.]

SPECIAL ORDER MODIFYING QUARANTINE LINE FOR THE STATE OF CALIFORNIA. (1901.)

U. S. Department of Agriculture,
Office of the Secretary,
Washington, D. C., December 14, 1900.

In accordance with the regulations concerning cattle transportation issued by this Department, the State of California has agreed to establish and to cooperate in the enforcement of a quarantine line located as follows:

Beginning on the Pacific Coast where the northern boundary line of Monterey County connects with the Pacific Ocean; thence easterly along the northern boundary of Monterey and San Benito counties to the western boundary line of Merced County; thence northerly, easterly, and southerly along the western, northern, and eastern boundary line of Merced County to the southeast corner thereof; thence northeasterly along the northern boundary of Madera County to the northeast corner thereof; thence southerly and easterly along the eastern boundary lines of Madera, Fresno, and Tulare counties to the southeast corner of Tulare County; thence easterly along the southern boundary line of Inyo County to its intersection with the eastern boundary line of the State of California.

And whereas said quarantine line, as above set forth, is satisfactory to this Department, and legislation has been enacted by the State of California to enforce said quarantine line, therefore the above quarantine line is adopted for the State of California by this Department for the period beginning on January 1, 1901, and ending December 31, 1901, in lieu of the quarantine line described in the order of December 10, 1900, for said area, unless otherwise ordered.

James Wilson, *Secretary.*

[B. A. I. Order No. 87.]

SPECIAL ORDER MODIFYING QUARANTINE LINE FOR THE STATE OF GEORGIA. (1901).

U. S. Department of Agriculture,
Office of the Secretary,
Washington, D. C., December 14, 1900.

In accordance with the regulations concerning cattle transportation issued by this Department, the State of Georgia has agreed to establish and to cooperate in the enforcement of a quarantine line located as follows:

Beginning at the intersection of the western boundary line of Union County with the boundary line between the States of Georgia and North Carolina; thence southerly along the western boundary of Union County to the southwest corner thereof; thence northeasterly along the southern boundary line of Union County to its intersection with the boundary line of Towns County; thence southerly, easterly, and northerly along the boundary line of Towns County to the western corner of Rabun County near the mouth of Wild Cat Creek; thence in an easterly direction through Charlie Mountain, Glassie Mountain, and Tiger Mountain, and along the ridge following Stekota Creek to Dick Creek; thence northerly through Rainy Mountain, Hogback Ridge, Pinnacle, Raven Knob, Rock Mountain, and Rabun Bald to the State boundary between Georgia and North Carolina.

That portion of the quarantine line for the State of North Carolina, described in the order of December 14, 1900 (B. A. I. Order 85), beginning at the intersection of the northwest corner of Union County, Georgia, with the State line, extending east along the southern boundary line of North Carolina to the intersection with the ridge extending from Rabun Bald to the State line, is hereby suspended during the enforcement of the above line for the State of Georgia.

And whereas said quarantine line, as above set forth, is satisfactory to this Department, and legislation has been enacted by the State of Georgia to enforce said quarantine line, therefore the above quarantine line is adopted for the State of Georgia by this Department for the period beginning on January 1, 1901, and ending December 31, 1901, in lieu of the quarantine line described in the order of December 10, 1900, for said area, unless otherwise ordered.

James Wilson, *Secretary.*

[B. A. I. ORDER NO. 88.—AMENDMENT TO B. A. I. ORDER NO. 80.]

REGULATIONS CONCERNING CATTLE TRANSPORTATION.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., December 22, 1900.

In order that protection may be given to cattle in certain counties of the State of Texas which are uninfected with the disease known as splenetic, Southern, or Texas, fever—

It is hereby ordered, That no cattle originating in the quarantined district as described in B. A. I. Order No. 80, as modified, shall be moved or allowed to move into the counties of Throckmorton or Baylor and that portion of the county of Pecos lying north and west of the line described as follows:

Beginning at the west line of Pecos County at the point where the roadbed of the C. H. & S. A. Railroad crosses said line; thence in an easterly direction with the center of said roadbed to a point on section No. 36, Block A 2, G. H. & S. A. Railroad Company; thence north with the pasture fence running in a northerly direction through the eastern part of sections Nos. 13 and 12 said Block A 2, and across section No. 1, G. C. & S. F. Railroad Company; thence continuing north with said pasture fence through the eastern part of sections Nos. 16, 17, 46, 47, 76, 77, 106, 107, 136, 137, 142, 143, and 194, Block D, M. K. & T. E. Railroad Company; thence continuing in a northerly direction to a point on the north line of section No. 6, block 160, G. C. & S. F. Railroad Company, same being corner of pasture fence; thence east with the north line of sections Nos. 6, 9, 10, 11, 12, 15, 16, block 160, G. C. & S. F. Railroad Company to the northeast corner of said section No. 16, same being corner of pasture fence; thence in a northerly direction with the east boundary line of sections Nos. 22, 21, 20, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, block 1, C. C. S. D. & R. G. N. G. Railroad Company to the northeast corner of said section 32; thence west with the north boundary line of sections Nos. 32 and 33, same block, to the northwest corner of section No. 33, block 1, C. C. S. D. & R. G. N. G. Railroad Company corner of fence; thence north with the east boundary line of sections Nos. 1, 12, 13, 24, 25, 36, 37, 48, 49, 60, 61, and 72, block 2, C. C. S. D. & R. G. N. G. Railroad Company to the northeast corner of said section No. 72; thence in an easterly direction with the pasture fence to the southeast corner of section No. 9, patented to James E. Evans; thence north with the east line of said section No. 9 to the northwest corner of section No. 100, Block A 2, T. C. Railroad Company; thence east with north boundary line of said sections Nos. 100 and 89, same block, to the northeast corner of said section No. 89, Block A 2, T. C. Railroad Company; thence north with the east boundary line of sections Nos. 90, 91, 92, and 93, to the southeast corner of section No. 94, Block A 2, T. C. Railroad Company; thence northwest diagonally across section No. 94 to the northwest corner of said section; thence continuing in a northwestern direction, diagonally across sections Nos. 14, 18, and 28 to the northeast corner of section No. 29, Block C 4, G. C. & S. F. Railroad Company; thence west with the north boundary line of said section No. 29 to the northwest corner of said section; thence northwest diagonally across section No. 1, T. C. Railroad Company, section No. 97, block 194, G. C. & S. F. Railroad Company, to the northwest corner of said section No. 96; thence in a northerly direction across section No. 94 to a point on the north boundary line 600 varas west of its northeast corner; thence continuing north through sections Nos. 93, 90, 89, 86, 85, and 58, block 194, G. C. & S. F. Railroad Company to a point on the north boundary line of said section No. 58; thence northwesterly with the pasture fence, through section No. 59 to the northeast corner of section No. 82 to the southeast corner of section No. 81, same block; thence continuing northwesterly to section No. 17, H. & G. N. Railroad Company; thence north with the east line of said section 17 to the Pecos River; thence up said Pecos River to the northwest corner of Crockett County; thence northwesterly with said Pecos River to the northwest corner of Crockett County.

And it is further ordered, That no cattle shall be moved or allowed to move from the counties of Throckmorton and Baylor and that portion of the county of Pecos as described above to any of that territory in the State of Texas lying west and north of said counties, except after having been inspected and found free of infection by duly authorized inspectors of this Department or of the State of Texas, and upon written permission by such officer. No cattle from said counties shall be moved or allowed to move to any State or Territory outside of the quarantine district (except as provided for immediate slaughter) unless they have been duly inspected and passed, and permit issued by inspectors of this Department, nor until permission has been obtained from the proper officials of the State or Territory to which said cattle are destined.

This order to remain in force until otherwise ordered.

JAMES WILSON, *Secretary.*

[B. A. I. ORDER No. 89.—AMENDMENT TO B. A. I. ORDER No. 80.]

REGULATIONS CONCERNING CATTLE TRANSPORTATION.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., December 22, 1900.

In order that protection may be given to cattle in certain counties of the State of North Carolina which are uninfected with the disease known as splenetic, Southern, or Texas, fever—

It is hereby ordered, That no cattle originating in the quarantined district as described in B. A. I. Order No. 80, as modified, shall be moved or allowed to move into the counties of Surry and Caldwell, and that portion of the county of Wilkes lying north and west of the Yadkin River, and that portion of the county of Burke lying north and west of the Catawba River, and that portion of the county of McDowell lying north and west of Catawba River and including the townships of Broad River, Crooker Creek, and Old Fort.

And it is further ordered, That no cattle shall be moved or allowed to move from the counties of Surry, Caldwell, and those portions of the counties of Wilkes, Burke, and McDowell, as above described, to any of that territory in the State of North Carolina lying west and north of said counties, except after having been inspected and found free of infection by duly authorized inspectors of this Department or of the State of North Carolina, and upon written permission by such officer. No cattle from said counties shall be moved or allowed to move to any State or Territory outside of the quarantined district (except as provided for immediate slaughter), unless they have been duly inspected and passed, and permit issued by inspectors of this Department, nor until permission has been obtained from the proper officials of the State or Territory to which destined.

This order to remain in force until otherwise ordered.

JAMES WILSON, *Secretary.*

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